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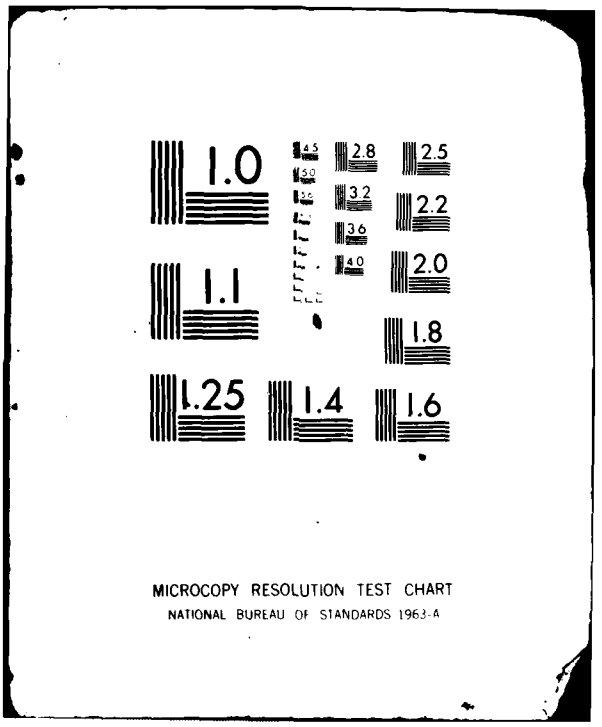
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MX SITING INVESTIGATION
GEOTECHNICAL EVALUATION

VERIFICATION STUDY - RALSTON VALLEY, NEVADA

VOLUME II - GEOTECHNICAL DATA

Prepared for:

U.S. Department of the Air Force
Ballistic Missile Office (BMO)
Norton Air Force Base, California 92409

Prepared by:

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15 June 1980

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

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1. REPORT NUMBER: FNTR 27-RV-II	2. GOVT ACCESSION NO.: AD-A112 998
3. RECIPIENT'S CATALOG NUMBER:	
4. TITLE (and Subtitle): Verification study - Ralston Valley Nevada Volume II Geotechnical Data	5. TYPE OF REPORT & PERIOD COVERED: Final
	6. PERFORMING ORG. REPORT NUMBER: FNI-TR-27-RV-II
7. AUTHOR(s): Fugro National, Inc.	8. CONTRACT OR GRANT NUMBER(s): F04704-80-C-0004
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Ertec Western Inc. (formerly Fugro National) P.O. Box 7765 Long Beach Ca 90807	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: 64312 F
11. CONTROLLING OFFICE NAME AND ADDRESS: U.S. Department of the Air Force Space and Missile Systems Organization Norton AFB Ca 92409 (SAMSO)	12. REPORT DATE: 15 Jun 80 13. NUMBER OF PAGES: 23
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report): — 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Distribution Unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

Distribution Unlimited

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Geologic ~~station~~, Ground-water, Seismic, Boring logs, trench logs, refraction, cone penetrometer, electrical resistivity, [illegible]

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report contains the field data & lab test results from the investigation of Ralston Valley, Nevada. [illegible]

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FOREWORD

This volume of geotechnical data was compiled for the Department of the Air Force, Ballistic Missile Office (BMO), in compliance with Contract No. F04704-80-C-0006, CDRL Item D04A2. It contains the field data and laboratory test results from the investigation of Ralston Valley. A synthesis of these data is available in Volume I (FN-TR-27-RV-I).

The data in each section of this volume are preceded by an explanation of the format and terms used in the compilation.

TABLE OF CONTENTS

SECTION 1.0

GEOLOGIC STATION DATA

1.0 EXPLANATIONS OF GEOLOGIC STATION DATA

Geologic stations were established at selected locations throughout the valley at which detailed descriptions of surficial basin-fill deposits or rock were recorded. Locations of all geologic stations are shown in Drawing II-1-1, Activity Location Map (in pocket). All data taken on surficial basin-fill units at these stations are listed in Table II-1-1 and an explanation of the column headings in the table is given below. At stations where rock descriptions were made, only geologic unit designations are listed. A general explanation of all geologic unit symbols used in Verification Studies is included at the end of this section.

Column Heading Table II-1-1	Explanation
Station Number	Geologic stations are numbered sequentially. Where more than one geologic field team worked in a CDP, stations made by each team are differentiated with a letter (A, B, or C) following the station number.
Geologic Unit	Generic geologic unit only, i.e. the grain-size designation (f, s, g, c) is omitted from surficial basin-fill units. The letter B in the unit designation indicates a buried deposit not exposed at the surface.
MPS MM	Average maximum particle size in millimeters.
Grain Size (%B, %C, %G, %S, %F)	Estimated particle size distribution using the Unified Soil Classification System. Percentages of boulders (%B) and cobbles (%C) are based on the entire deposit, whereas percentages of gravel (%G), sand (%S) and fines (%F) are taken only on the fraction composed of particles less than 3 inches (76 mm) in diameter.
USCS	Soil class according to the Unified Soil Classification System.

Munsell Color — Soil color based on Munsell Soil Color Chart.

Source Rock Types(s) — Rock types of coarse clasts listed in order of abundance.

* Physical Properties — Data listed in columns 6 through 15 address specific soil properties. These are listed below in parentheses following the column heading number and are also listed at the bottom of Table II-1-1. Data are coded with each numerical entry referring to a specific soil condition as listed below.

6	(Grain Shape)	1) Angular, 2) Subangular, 3) Subrounded, 4) Rounded, 5) Well rounded
7	(Moisture Content)	1) Dry, 2) Moist, 3) Wet
8	(Plasticity of Fines)	1) None, 2) Low, 3) Medium, 4) High
9	(Consistency)	Coarse grained: 1) Very Loose, 2) Loose, 3) Medium Dense, 4) Dense, 5) Very Dense, Fine grained: 1) Soft, 2) Firm, 3) Stiff, 4) Hard
10	(Structure)	1) Stratified Tabular, 2) Stratified Other (lensed, cross bedded, discontinuous beds), 3) Nonstratified
11	(Cementation Induration)	1) None, 2) Weak, 3) Moderate, 4) Strong
12	(Depth to Cemented Layers)	Depth to layer (in centimeters) exhibiting cementation induration described in Column 11 (above)
13	(Weathering of clasts)	1) Fresh, 2) Slight, 3) Moderate, 4) Very
14	(Soil Profile Development)	1) None (A-C profile), 2) Poor (incipient B-horizon), 3) Well (prominant B-horizon)
15	(Caliche Development)	1) Stage I, 2) Stage II, 3) Stage III, 4) Stage IV, 5) None

Drainage

DP (M)	Average depth of drainages (in meters)
WD (M)	Average width of drainages (in meters)
Slope (%)	Average slope of ground surface (in percent grade)
Sample	Number of samples taken

GENERALIZED GEOLOGIC UNITS

Explanation

Surficial Basin-fill Units

A1 Younger Fluvial Deposits - Major modern stream channel and flood-plain deposits.

A2 Older Fluvial Deposits - Older incised stream channel and flood-plain deposits in elevated terraces bordering major modern drainages.

A3 Eolian Deposits - Wind-blown deposits of sand occurring as either thin sheets (A3s) or dunes (A3d).

A4 Playa and Lacustrine Deposits - Deposits occurring in modern, active playas (A4) or in either inactive playas or older lake beds and abandoned shorelines associated with extinct lakes (A4o).

A5 Alluvial Fan Deposits - Alluvial deposits consisting of debris flow and water-laid alluvium near mountain fronts, grading into predominantly water-laid alluvium deposited in shifting distributary channels near the basin center. Younger (A5y), intermediate (A5i), and older (A5o) alluvial fans are differentiated by surface soil development, terrain conditions, and present depositional/erosional environment.

Grain sizes of these deposits (except A3 deposits, which are exclusively sandy) are indicated by a single letter (f, s, g, or c) following the geologic unit symbol. These letters indicate the predominant grain size and range of soil types according to the Unified Soil Classification System.

f - fine-grained (ML, CL, MH, CH)

s - sands (SP, SW, SM, SC)

g - gravels (GP, GW, GM, GC)

c - coarse grained with greater than 30 percent boulders and cobbles (generally GP, GW, GM, GC)

ROCK UNITS

I Igneous (undifferentiated). Rocks formed by solidification of a molten or partially molten mass.

I1 Intrusive - Plutonic rocks formed by solidification of molten material beneath the surface (e.g., granite, granodiorite, diorite, gabbro).

I2 Extrusive (intermediate and acidic) - Volcanic rocks of intermediate and acidic compositon formed by solidification of molten material at or near the surface, (e.g., rhyolite, latite, dacite, andesite).

I3 Extrusive (basic) - Volcanic rocks of basic composition, generally formed by solidification of molten materials at or near the surface (e.g., basalt).

I4 Extrusive (pyroclistic) - Rocks formed by accumulation of volcanic ejecta (e.g., ash, tuff, welded tuff, agglomerate).

S Sedimentary (undifferentiated) - Rocks formed by accumulation of clastic solids, organic solids and/or chemically precipitated minerals.

S1 Arenaceous and/or Siliceous Rocks - Composed of sand size particles (e.g., sandstone, orthoquartzite) or of cryptocrystalline silica (e.g., opal, chert).

S2 Carbonate Rocks - Composed predominantly of calcium carbonate detritus or chemical precipitates (e.g., limestone, dolomite, chalk).

S3 Argillaceous Rocks - Composed of clay and silt-sized particles (e.g., siltstone, shale, claystone).

S4 Evaporite Rocks - Precipitated from solution as a result of evaporation (e.g., halite, gypsum, anhydrite, sylvite).

S5 Coarse Clastic Rocks - Composed of gravel sized or larger clasts (e.g., conglomerate, breccia).

M Metamorphic (undifferentiated) - Rocks formed through recrystallization in the solid state of preexisting rocks by heat and pressure (e.g., gneiss, schist, hornfels, metaquartzite).

SOIL DESCRIPTIONS — TABLE II-1-1

STATION NUMBER	GEOL UNIT	MOI %	GRAIN SIZE AT %	GS %	SS %	USCS	MUNSELL COLOR	SOURCE ROCK TYPE(S)	*PHYSICAL PROPERTIES n	7	8	9	10	11	12	13	14	15	CEMENTATION (TSF)	SWELL (%)	SHEAR (°)	SA PLE
NRVG01	A5Y	020				SM		I2	2	1	2	3	3	2		018	2	1				
NRVG01M	A5I	060	01	30	15	045	020	SM	10.0YR4/4	I3	1	2	1	3	3	1		2	1	1			0
NRVG02	A5I	050						SM		I2	2	1	2	2	2	2	052	2	2	2			
NRVG02B	A5I	180	00	02	05	075	020	SM	07.5YR5/4	I3	2	1	2	3	3	1		2	3	1	3.5	0.4	34	0
NRVG03	A5I	040						SM		I2	2	1	2	3	3	3	034	2	2	3				
NRVG03M	A5I	120	01	05	03	072	025	SM-SC	10.0YR4/4	I3	2	2	2	3	3	2	040	2	2	1	1.5	0.8	32	0
NRVG04M	A5I	069	00	01	35	060	025	SM	07.5YR5/4	I2 I3	1	2	1	3	3	2	026	2	3	2	1.5	0.4	34	0
NRVG05B	A5Y	058	00	00	02	083	015	SM	10.0YR5/4	I2	2	2	1	3	3	2	048	2	1	1			34	0
NRVG06M	A5Y	055	00	00	10	075	015	SM	10.0YR6/4	I2	2	3	1	3	3	1		2	1	1	.0	0.0	05	0
NRVG07M	A5Y	035	00	00	05	088	007	SM-SM	10.0YR6/4	I2	3	2	1	3	3	1		2	1	1	.3	0.3	02	0
NRVG08	A3S	120						SM		M S2 I2	2	1	1	1	3	1			1	1				
NRVG08B	A5Y	035	00	00	05	075	020	SM	10.0YR5/4	I2	2	2	1	3	3	2	049	2	1	1	.0	0.0	00	0
NRVG09	A5I	050						ML-SM				1	3	2	3	2	030		1	2				
NRVG09M	A4	013	00	00	05	045	050	CL	07.5YR4/4	I2	3	2	2	3	2	1		2	1	3	.0	0.0	00	1
NRVG10M	A4	000	00	00	00	050	050	SC-CL	10.0YR5/6			1	3	3	3	1			1	3	.0	0.0	00	0
NRVG11	A5D	060						SM		I3	2	1	2	3	3	2	010	2	2	3				
NRVG11B	A3S	016	00	00	01	097	003	SP	10.0YR6/3	I2	3	2	1	3	3	1		2	1	3	.2	0.0	01	0
NRVG12	A5I	040						SM			2	2	3	3	3	3	050	2	2	3				
NRVG12A	A5Y	020	00	00	30	040	010	SM-SP		I2	2	2	1	3	3	2	060		2	2				
NRVG12B	A3S	030	00	00	01	097	003	SM	10.0YR5/6	I2	3	2	1	3	3	1		2	1	3	.0	0.0	01	0
NRVG13	A5I	040	00	00	05	055	040	SM		I2	2	1	2		3	2	022	2	2	2				
NRVG13M	A5Y	012	00	00	01	095	005	SM-SM	10.0YR4/4	I2	2	2	1	3	2	1			1	3	.0	0.0	01	0
NRVG14	A4D	030	00	00	05	070	025	SM		I2	2	2	2	3	3	2	020	2	3	3				
NRVG14M	A4	030	00	00	01	070	030	SC	10.0YR4/6	I2	2	3	2	3	3	2	024	2	1	1	.0	0.0	01	0
NRVG15	A4D	030	00	00	05	070	025	SM		I2	2	2	2	3	3	2	016	2	1	3				
NRVG15M	A5Y	014	00	00	01	087	013	SM	10.0YR5/4	I2	3	2	1	3	2	1			1	3	.0	0.0	00	0
NRVG16	A4D	030	00	00	12	065	003	SM		I2	3	3	1	3	2	2	012	2	1	1				
NRVG16M	A5Y	030	00	00	15	065	020	SM	10.0YR4/4	I2	2	2	1	3	2	1		2	1	1	.1	0.1	02	0
NRVG17	A5I	040	00	01	05	070	025	SM		I2 T1 S1	2	2	2	3	3	2	020	3		3				
NRVG17M	A5Y	029	00	00	05	080	015	SM	10.0YR5/4	I2	2	2	1	4	2	2	030	2	1	1	.0	0.0	01	0
NRVG18	A5I	040	00	00	20	085	015	SM		I2	2	1	2	3	3	2		2		2				
NRVG18B	A5Y	020	00	00	07	075	025	SM	10.0YR6/4		2	2	1	3	3	1			1	3	.0	0.0	00	0
NRVG19	A5I	020	00	00	05	090	050	SM		I2	2	2	1	3	3	2	018	2	3	3				
NRVG19B	A5Y	040	00	00	35	065	020	SM	10.0YR5/4	I2	2	1	1	3	3	2		2	2	1	.0	0.0	01	0
NRVG20	A3D	001	00	00	02	098	000	SM			2	2	1	3	3	1		2	1	3				
NRVG20M	A5Y	040	00	00	40	045	015	SC	10.0YR5/6	I2 I3	3	2	1	3	1	1		2	1	1	.0	0.0	00	0
NRVG21	A5I	040	00	00	30	065	005	SM-SM		I2	2	2	1	4	3	2	024	2	1	2				
NRVG21M	A5Y	050	00	00	20	035	045	SC	10.0YR5/6	I2	2	1	2	4	3	1		2	2	3	.0	0.0	01	0
NRVG22M	A5Y	045	00	00	10	075	015	SM	10.0YR5/6	I2	2	2	1	3	3	1		2	1	1	.1	0.1	01	0
NRVG23	A5Y	040	00	01	30	070	030	SM			2	2	1	2	2	1		2	1	1				
NRVG23M	A5Y	032	00	00	08	087	015	SM	10.0YR5/6	I2	2	1	1	3	3	1		2	2	1	.0	0.0	02	0
NRVG24B	A5I	130	00	01	15	070	015	SM	07.5YR5/4	I2 I3	2	1	1	3	4	1		2	3	1	2.0	1.2	34	0
NRVG25	A4		00	00	00	000	100	CL				3	4	3	2	1			3	3				
NRVG25M	A5I	176	00	05	20	065	015	SM	07.5YR5/4	I2	2	1	1	3	1	1		2	3	1	2.0	1.0	03	0
NRVG26	A5Y	020	00	00	20	065	010	SP-SM		I2	2	2	2	3	3	1		2	1	3				
NRVG26M	A5Y	070	00	01	05	075	020	SM	10.0YR5/4	I2	2	1	1	4	3	1		2	3	1	.0	0.1	02	0
NRVG27	A4							ML		I2		3	2		2	1		2	1	3				
NRVG27M	A5I	160	00	02	10	080	010	SC	07.5YR5/6	I2	2	1	2	4	3	1		2	3	2	.0	0.0	02	0
NRVG28M	A5D	130	00	01	20	065	015	SM	10.0YR5/4	I2 S1	2	1	1	3	3	2	028	2	2	2	.1	0.1	03	0
NRVG29M	A5Y	012	00	00	05	083	012	SM-SM	10.0YR4/4	I2	2	2	1	3	3	1			1	3	.0	0.0	02	0
NRVG02B	A5I	160	00	01	12	073	015	SM	10.0YR4/4	I2	2	1	1	4	3	2	025	2	3	1	.0	0.1	03	0

*PHYSICAL PROPERTIES :
6 = GRAIN SHAPE — 9 = CONSISTENCY — 12 = CEMENTATION (TSF) — 15 = CRACK DEVELOPMENT
7 = MOISTURE CONTENT — 10 = STRUCTURE — 13 = WEATHERING OF GRAINS
8 = PLASTICITY FINES — 11 = CEMENTATION-INSOLUBLES — 14 = SOIL PROFILE DEVELOPMENT

NOTE: GEOLOGIC STATIONS WHICH WERE USED ONLY FOR SITE SPECIFIC PHOTOGRAPHIC CHECKS AND/OR FOR GEOLOGIC DESCRIPTIONS ARE NOT LISTED.

GEOLOGIC STATION DATA
RALSTON VALLEY, NEVADA

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TABLE II-1-1

UGRO NATIONAL, INC.

SECTION 2.0

GROUND-WATER DATA

2.0 EXPLANATIONS OF GROUND-WATER DATA

Existing ground-water data in Ralston Valley were collected from all available sources. These data were updated where possible from measurements taken during Fugro field operations, and all data are shown in Table II-2-1. Locations of water wells and boreholes in which water-level measurements were available are shown in Drawing II 1-1. Well numbers listed in the left hand column of Table II-2-1 refer to well locations shown on Drawing II-1-1. Actual well numbers giving location according to the Bureau of Land Management Land Survey System are shown in the second column.

Water levels generally refer to the static ground-water table in the unconfined basin-fill aquifer. Perched conditions or levels in artesian aquifers are noted where known.

WELL NO.	WELL LOCATION NUMBER*	ELEVATION OF GROUND SURFACE - FEET (METERS) ABOVE M.S.L.	DEPTH OF WELL - FEET (METERS)	WATER LEVEL			REFERENCES**/ REMARKS
				DEPTH BELOW GROUND SURFACE - FEET (METERS)	DATE MEASURED	ELEVATION - FEET (METERS) ABOVE M.S.L.	
W1	4N/44E-08ab-2	5740 (1750)	80 (24.4)	9 (2.7)	1962	5731 (1747)	1,2,3
W2	4N/44E-08ba-1	5735 (1748)	83 (25.3)	9 (2.7)	1962	5726 (1745)	1,2,3
W3	4N/44E-08cc-1	5710 (1740)	38 (11.6)	8 (2.4)	1948	5702 (1738)	1,2,3
W4	4N/44E-18ad-2	5685 (1733)	47 (14.3)	11 (3.4)	1948	5674 (1729)	1,2,3
W5	4N/44E-19aa-1	5655 (1724)	55 (16.8)	8 (2.4)	1948	5647 (1721)	1,2,3
W6	3N/44E-16C-1	5487 (1672)	540 (164.6)	480 (146.3)	1947	5007 (1526)	1,2,3
W7	3N/44E-35d-1	5380 (1640)	— (--)	383 (116.7)	1960	4997 (1523)	1,2,3
W8	2N/44E-8b	5385 (1641)	264 (80.5)	>264 (>80.5)	—	<5121 (<1561)	1,2,3/ Dry
W9	2N/45E-21c-1	≈5250 (≈1600)	325 (99.1)	-- (--)	—	— (--)	1,2,3/***

* Mount Diablo Baseline and Meridian

** References
1. Eakin, T. E., 1962
2. United States Geological Survey, 1980
3. Robinson, B. P., and Others, 1967
4. Nevada State Engineers Office, 1974

*** Depth to Water not reported.

NOTE: All wells tap unconfined alluvial aquifers except where noted. Where published data are lacking or inaccurate, ground surface elevations are taken from topographic maps.

GROUND-WATER DATA
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

TABLE II-2-1

FUGRO NATIONAL, INC.

SECTION 3.0

SEISMIC REFRACTION DATA

3.0 EXPLANATIONS OF SEISMIC REFRACTION DATA

Note: There is no seismic refraction line designated as RV-S-11. Each figure shows seismic wave travel times plotted versus surface distance between the energy source (shot) and the detector (geophone) for a single seismic line. Distances are measured along the line from geophone number 1 which is designated as zero distance. Distances to the right (on the paper) of geophone 1 are positive. The direction arrow gives the approximate direction along the geophone array from geophone 1 to geophone 24.

Travel Time Versus Distance Graph (Upper Half of Figure)

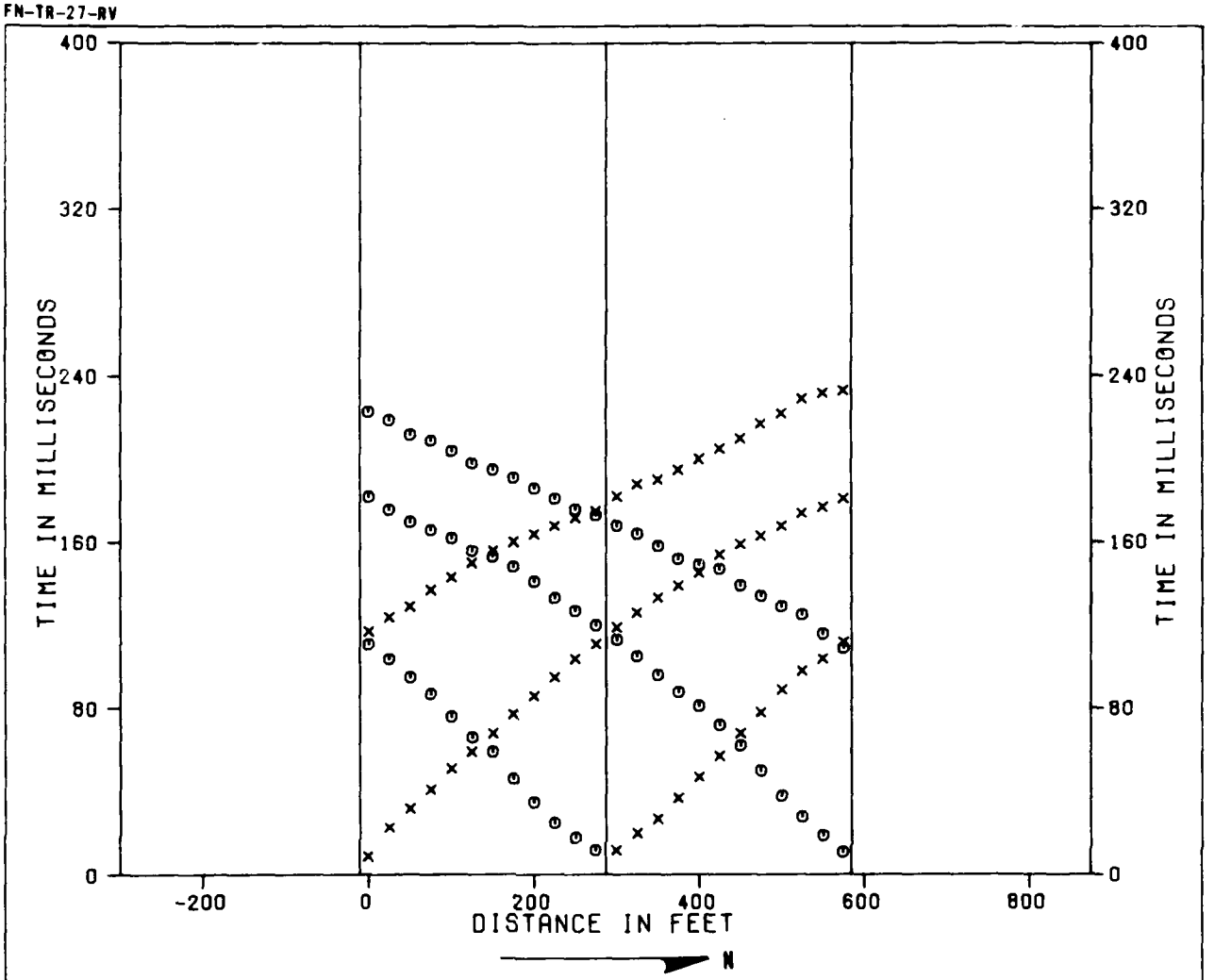
This is a travel time versus distance graph. The abscissa represents distance; the ordinate, time. The six vertical lines represent the locations of shots (designated as F, G, H, I, J, and K). The symbol, X, denotes travel times at geophones that were located to the right of a shot. The symbol, 0, denotes travel times that were located to the left of shots.

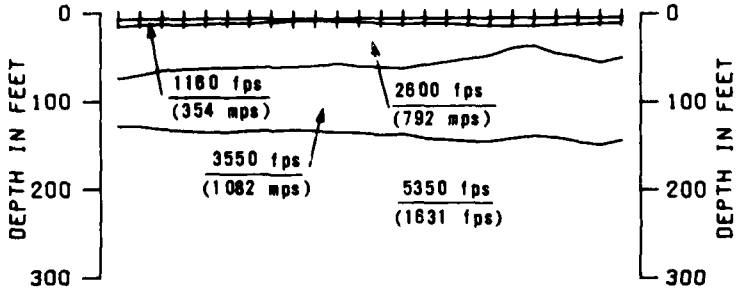
Velocity Cross Section (Lower Half of Figure)

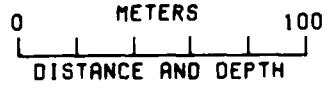
This is an interpreted velocity cross section beneath the seismic line. The top line represents the ground-surface profile. The short vertical lines crossing the top line mark the geophone positions. The depth scale is plotted relative to a point on the line which was arbitrarily chosen as "zero elevation" at the time the line was surveyed. The additional lines across the cross section represent the interpreted boundaries between layers of material with different compressional wave

velocities. These boundaries are commonly called "refractors". The velocity interpreted to be representative of each layer is shown.

FN-TR-27-RV







× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE RV-S-1
TIME-DISTANCE DATA AND VELOCITY PROFILE
RALSTON VALLEY, NEVADA

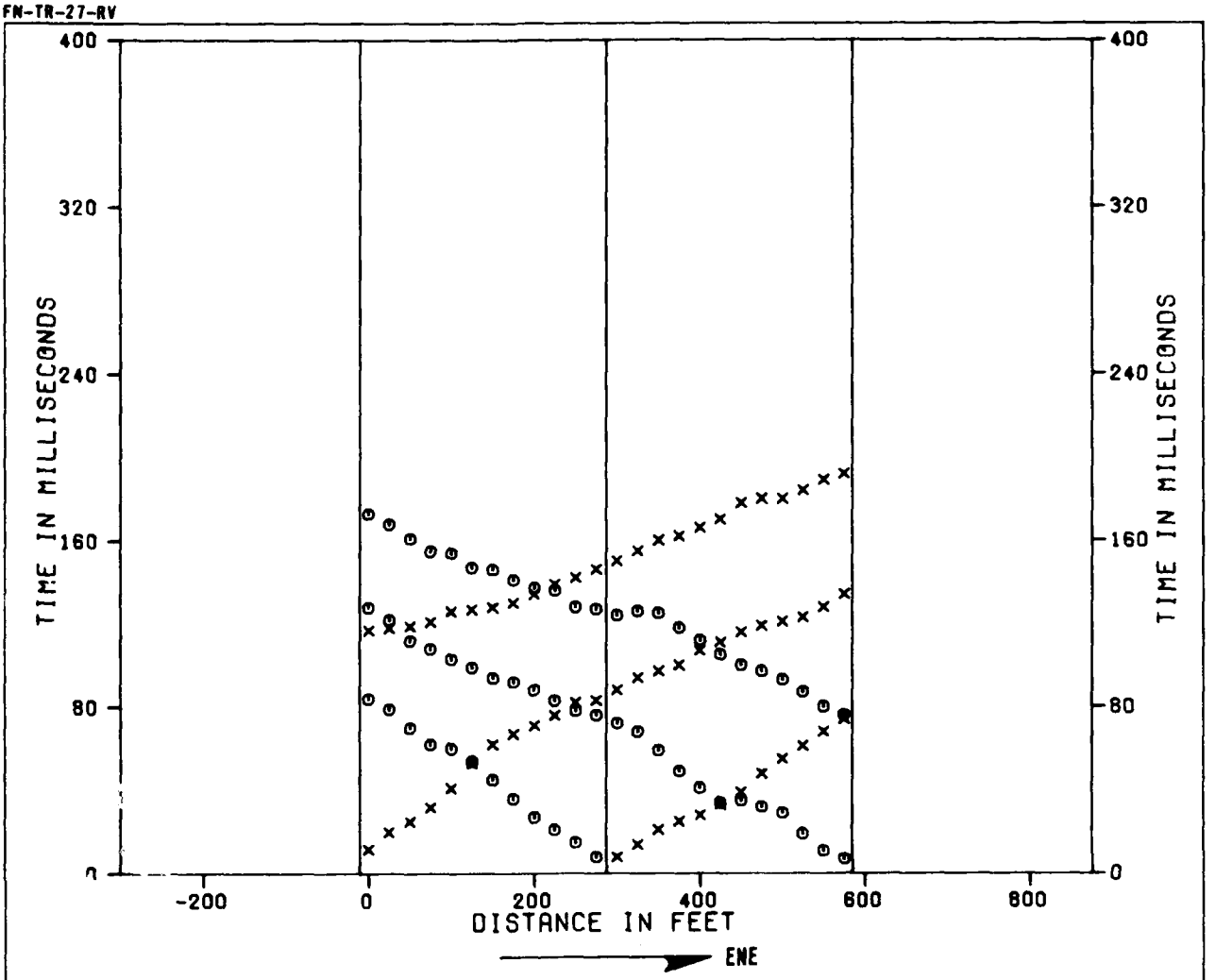
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

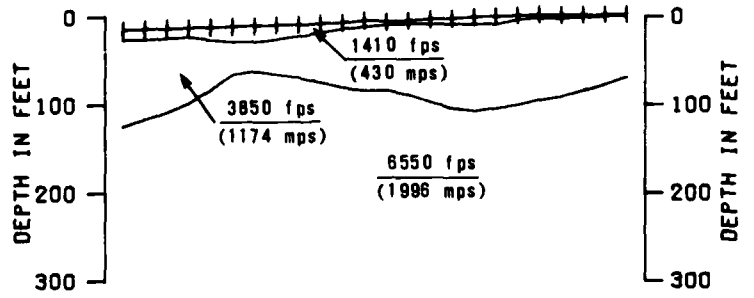
FIGURE
II-3-1

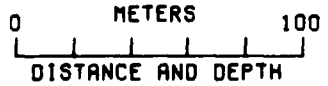
URS RESEARCH CO.

15 JUN 80

FN-TR-27-RV







× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE RV-S-2
TIME-DISTANCE DATA AND VELOCITY PROFILE
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-3-2

FURRO NATIONAL INC.

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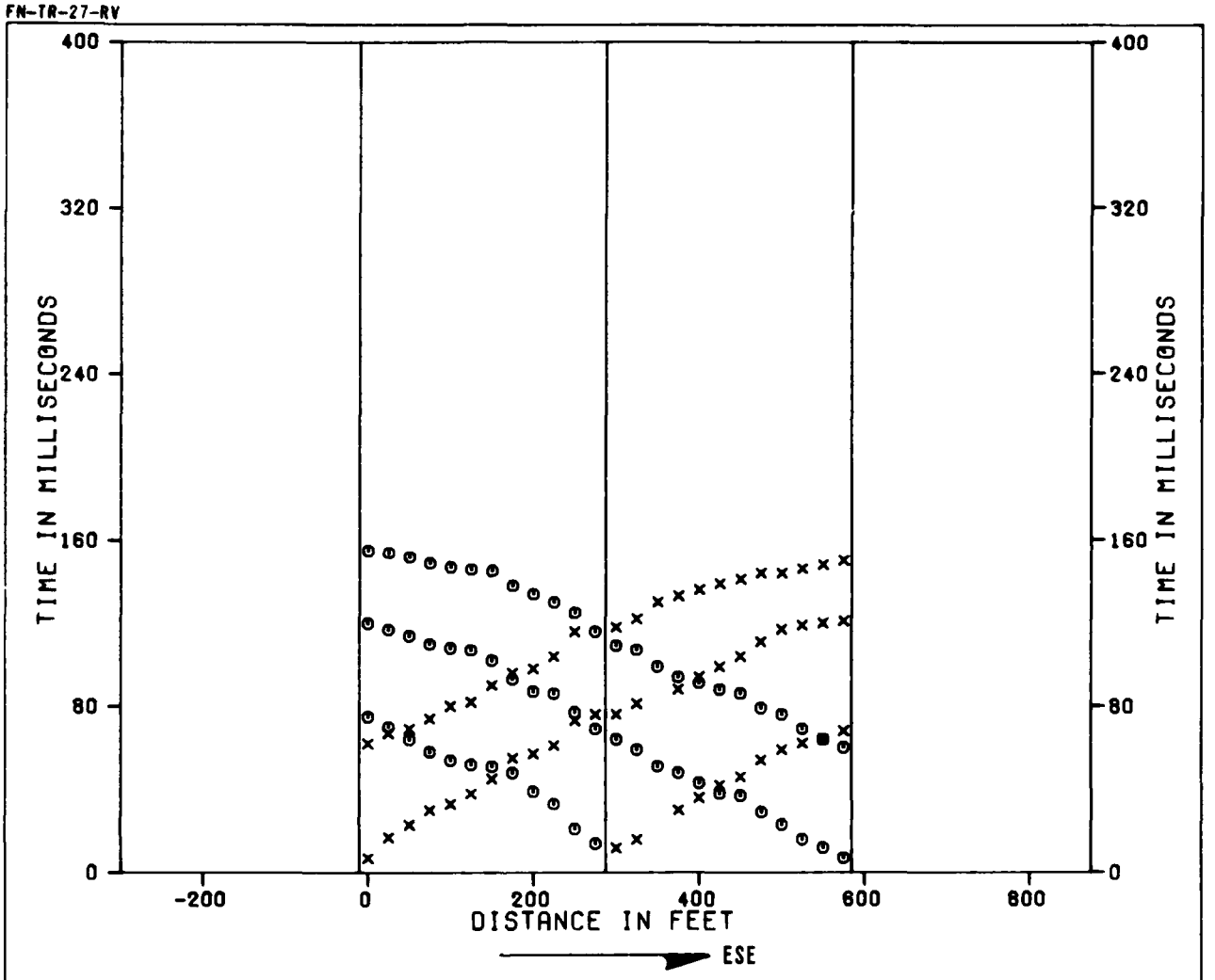
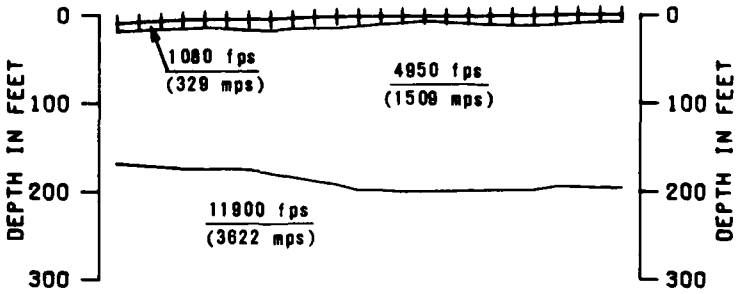
FN-TR-27-RV





0 METERS 100

DISTANCE AND DEPTH

× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE RV-S-3
TIME-DISTANCE DATA AND VELOCITY PROFILE
RALSTON VALLEY, NEVADA

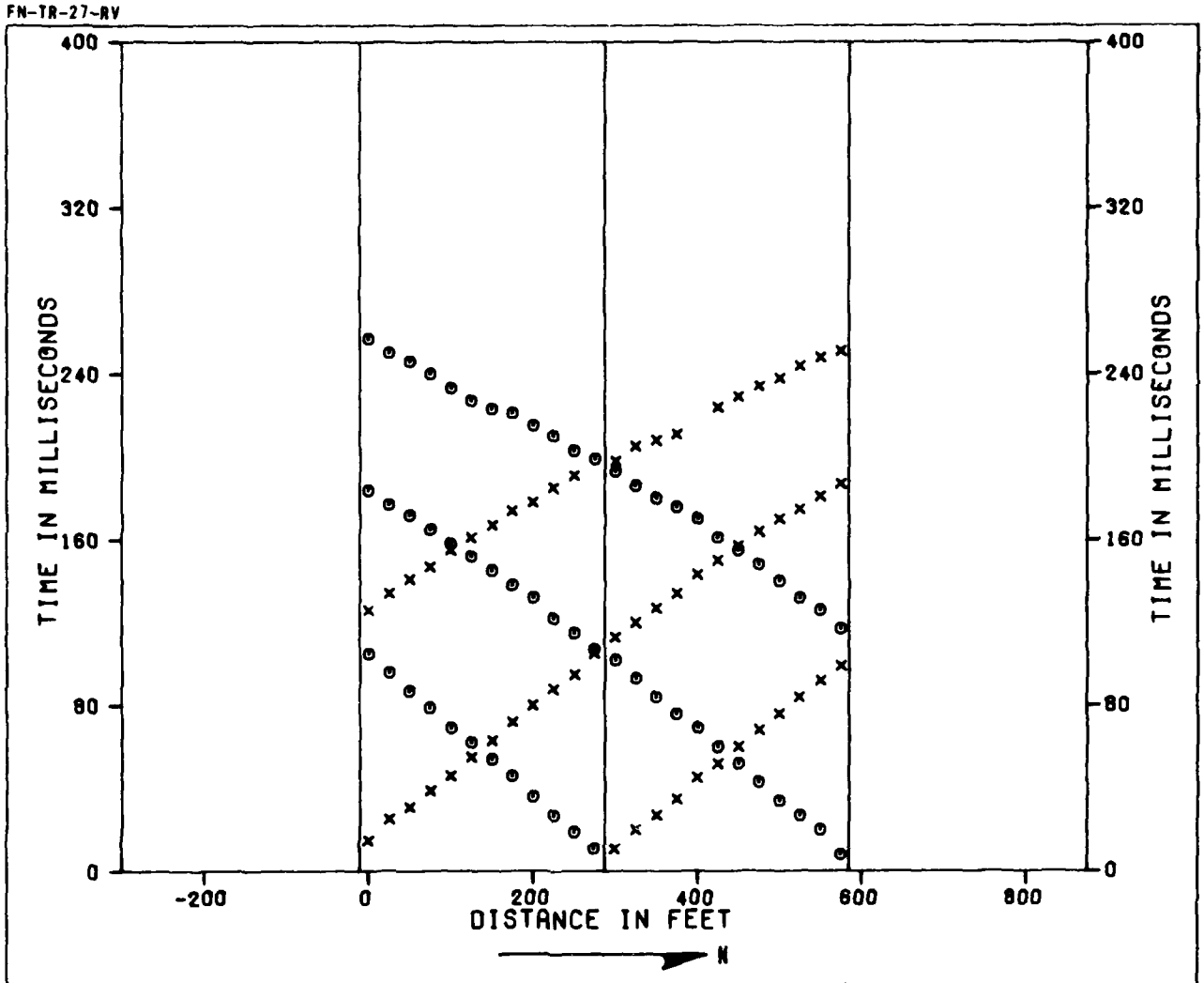
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

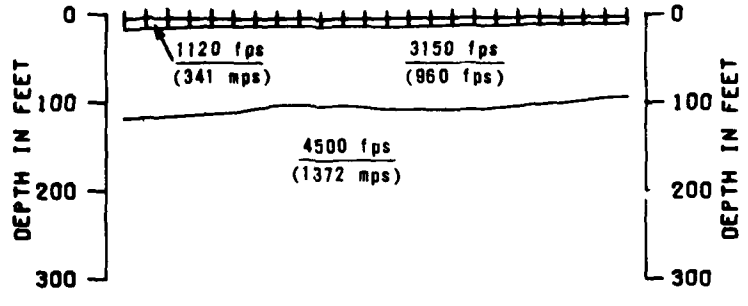
FIGURE
II-3-3

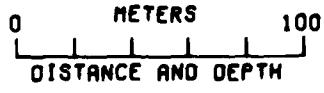
WOODWARD-CLYDE CONSULTANTS

15 JUN 80

FN-TR-27-RV







× TIMES TO RIGHT OF SHOTS
⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE RV-S-4
TIME-DISTANCE DATA AND VELOCITY PROFILE
RALSTON VALLEY, NEVADA

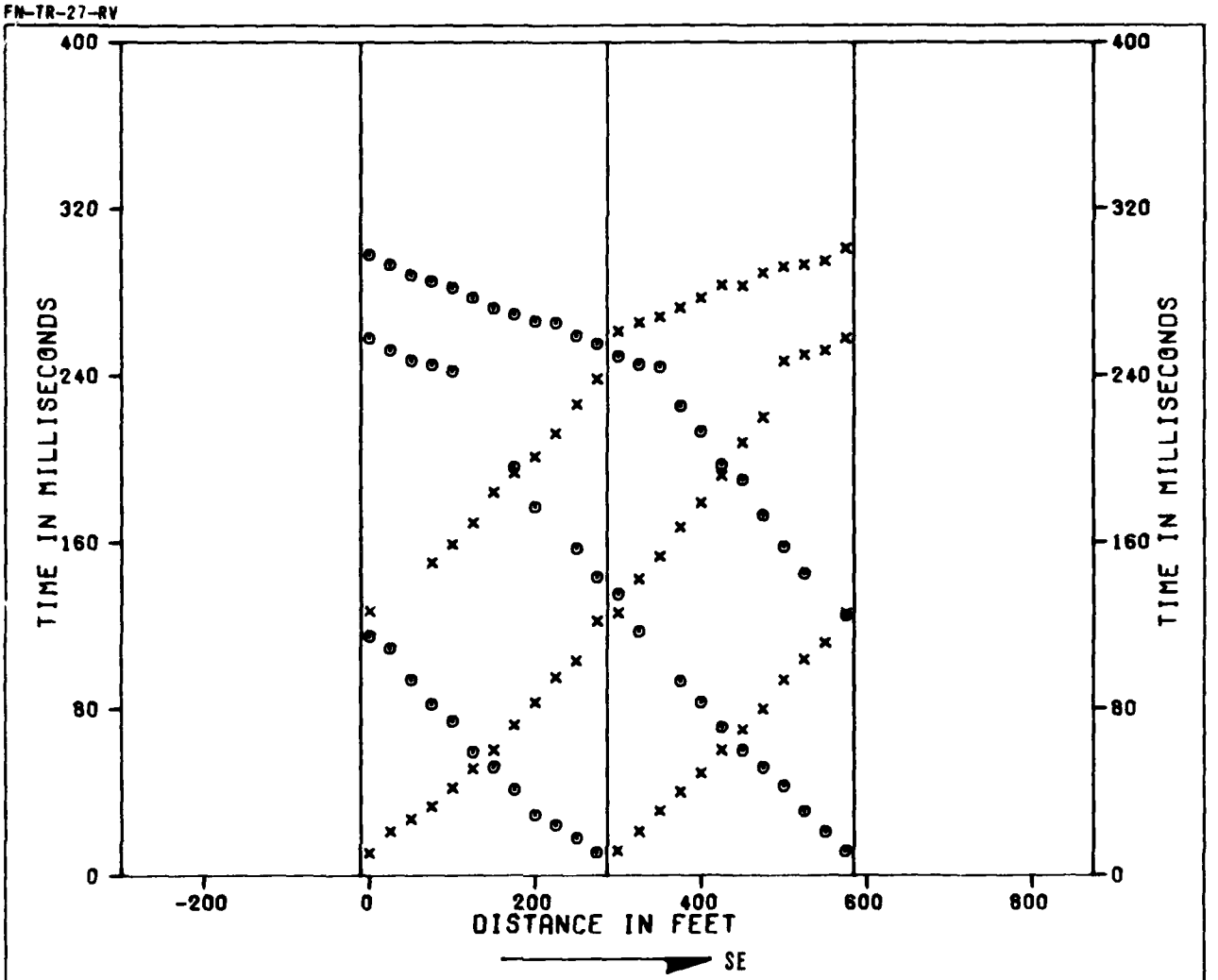
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

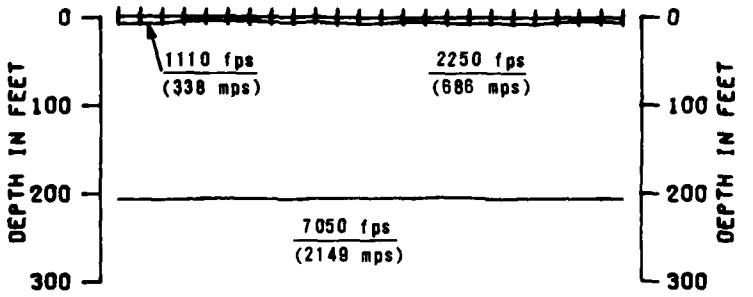
FIGURE
II-3-4

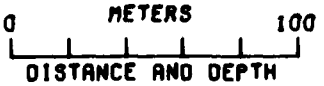
WOODWARD-CLYDE CONSULTANTS

15 JUN 80

FN-TR-27-RV







× TIMES TO RIGHT OF SHOTS
⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE RV-S-5
TIME-DISTANCE DATA AND VELOCITY PROFILE
RALSTON VALLEY, NEVADA

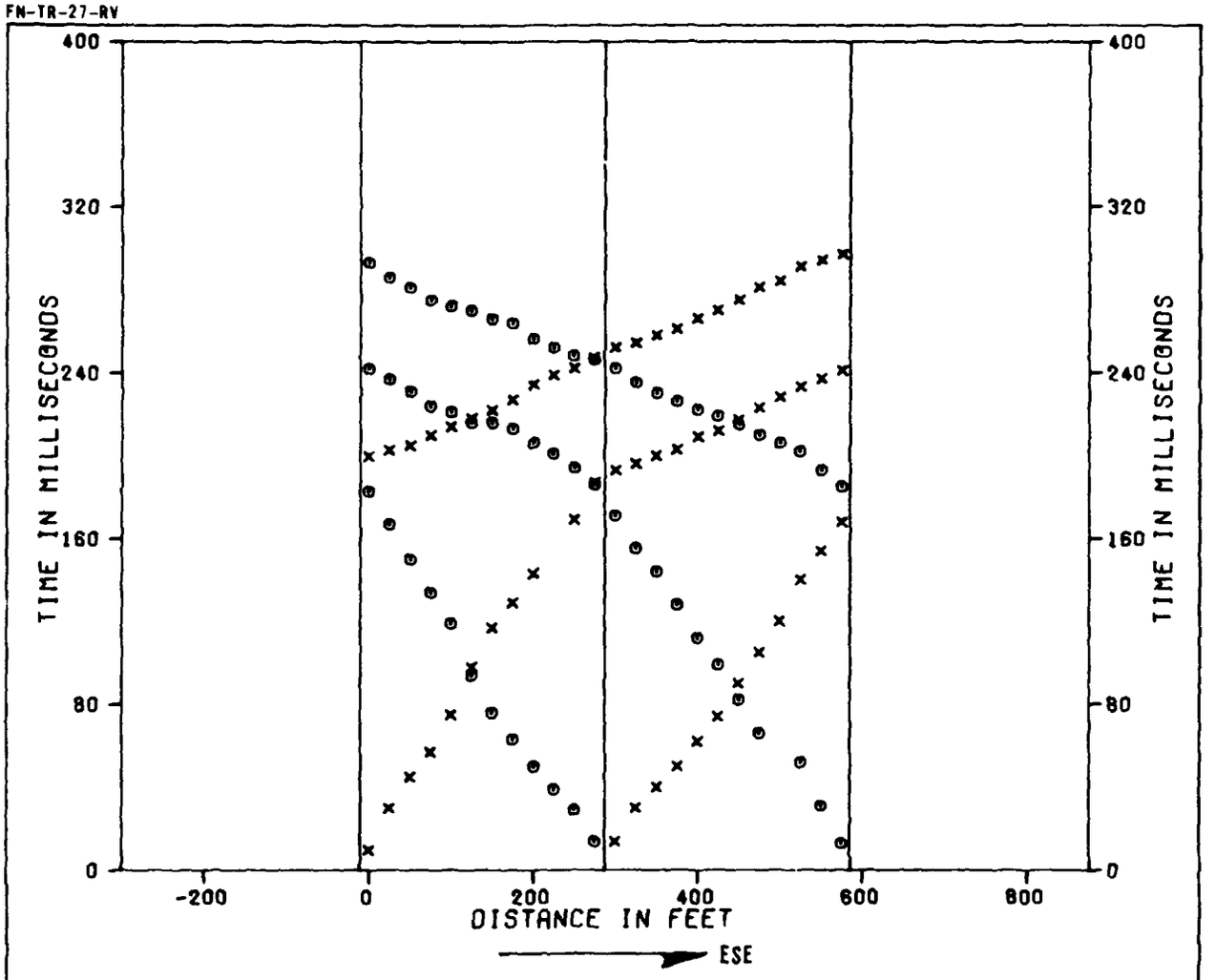
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

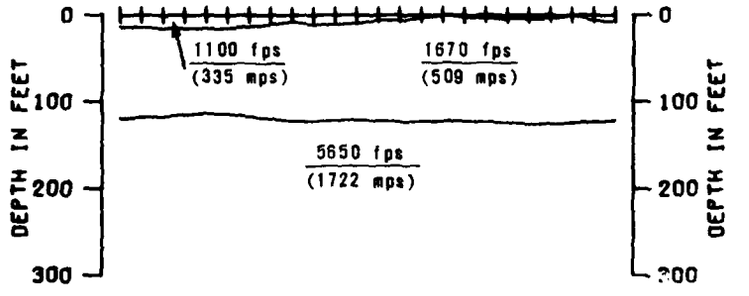
FIGURE
II-3-5

WOODWARD-NATIONAL, INC.

15 JUN 80

FN-TR-27-RV





0 METERS 100

DISTANCE AND DEPTH

× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE RV-S-6
TIME-DISTANCE DATA AND VELOCITY PROFILE
RALSTON VALLEY, NEVADA

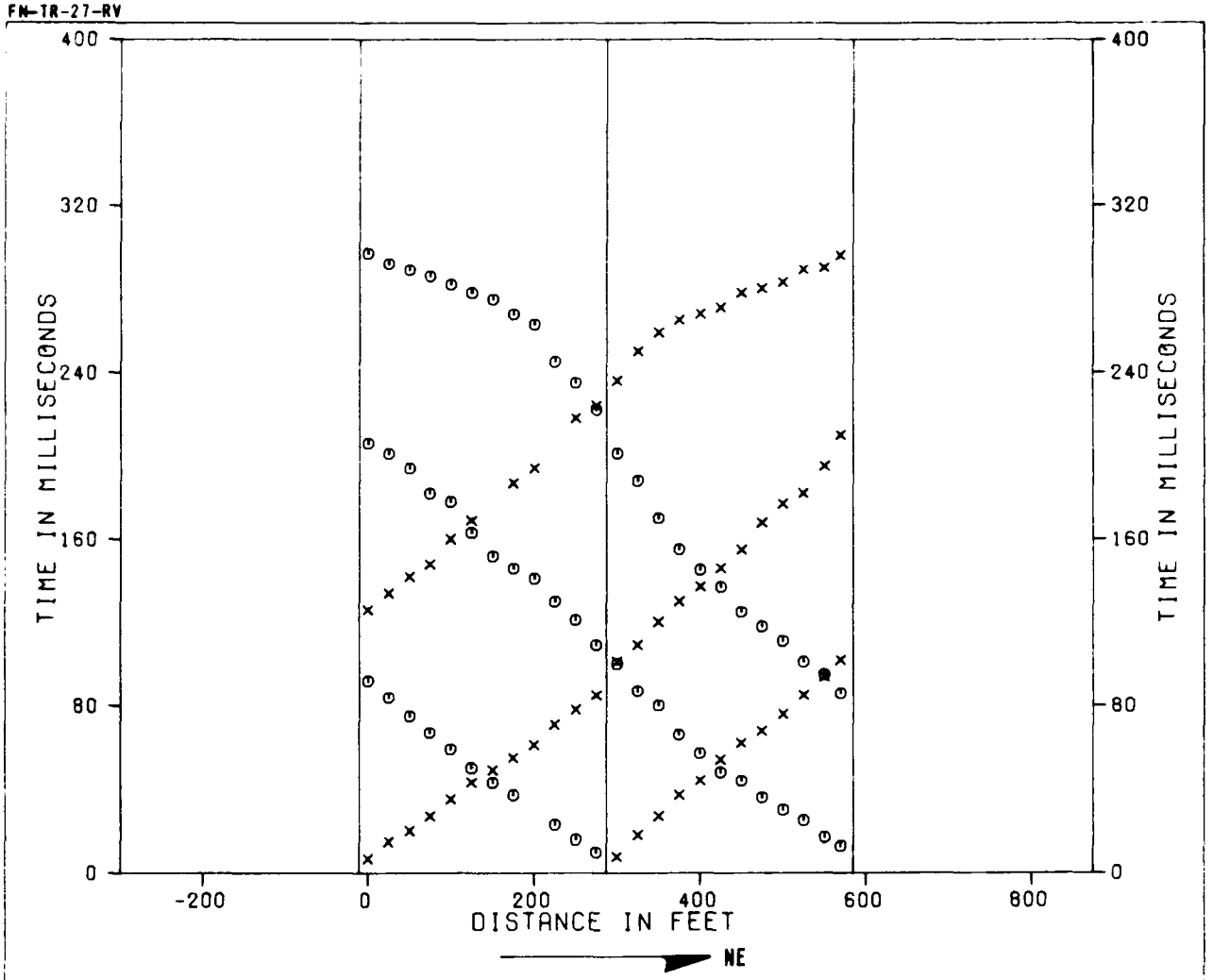
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

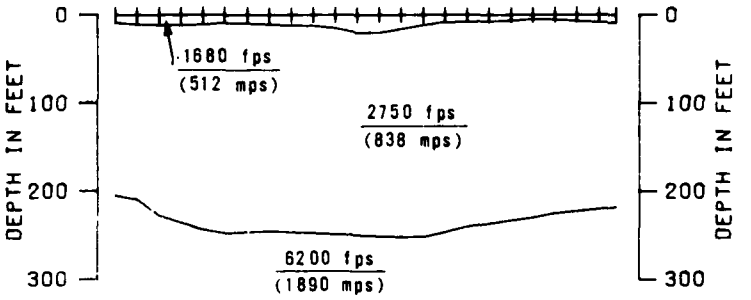
FIGURE
II-3-6

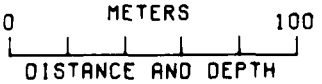
WOODWARD-NATIONAL, INC.

15 JUN 80

FN-TR-27-RV







× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE RV-S-7
TIME-DISTANCE DATA AND VELOCITY PROFILE
RALSTON VALLEY, NEVADA

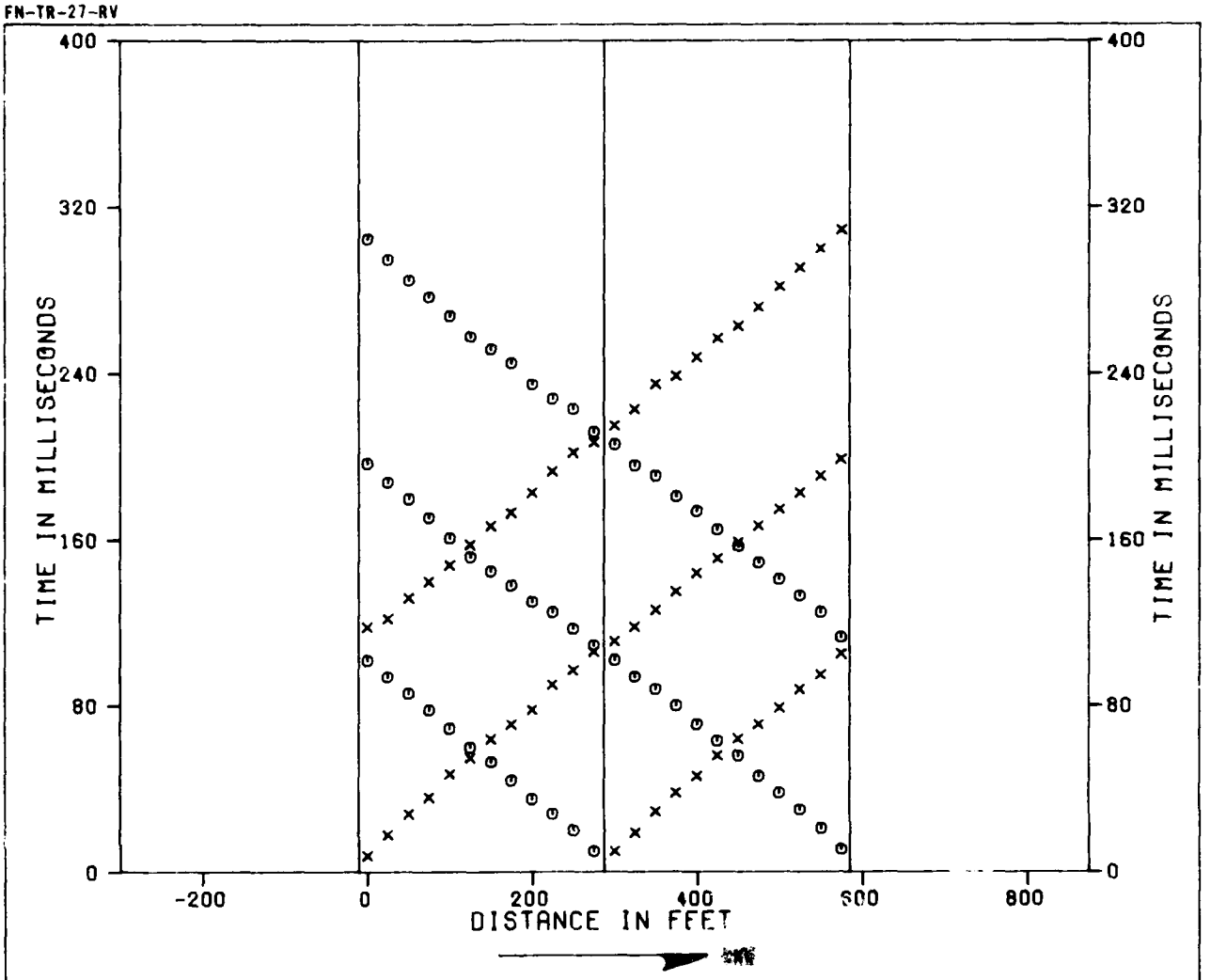
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

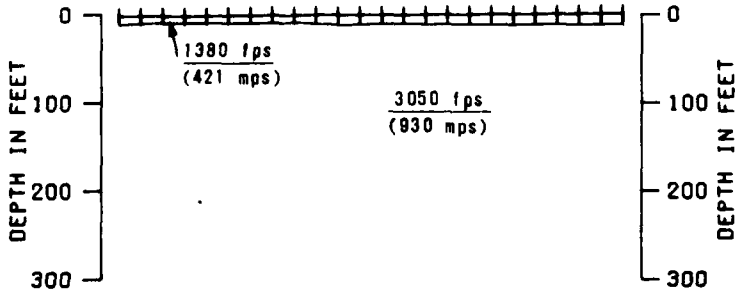
FIGURE
II-3-7

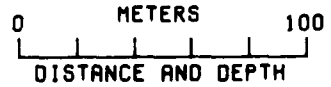
FUGRO NATIONAL, INC.

15 JUN 80

FN-TR-27-RV







× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE RV-S-8
TIME-DISTANCE DATA AND VELOCITY PROFILE
RALSTON VALLEY, NEVADA

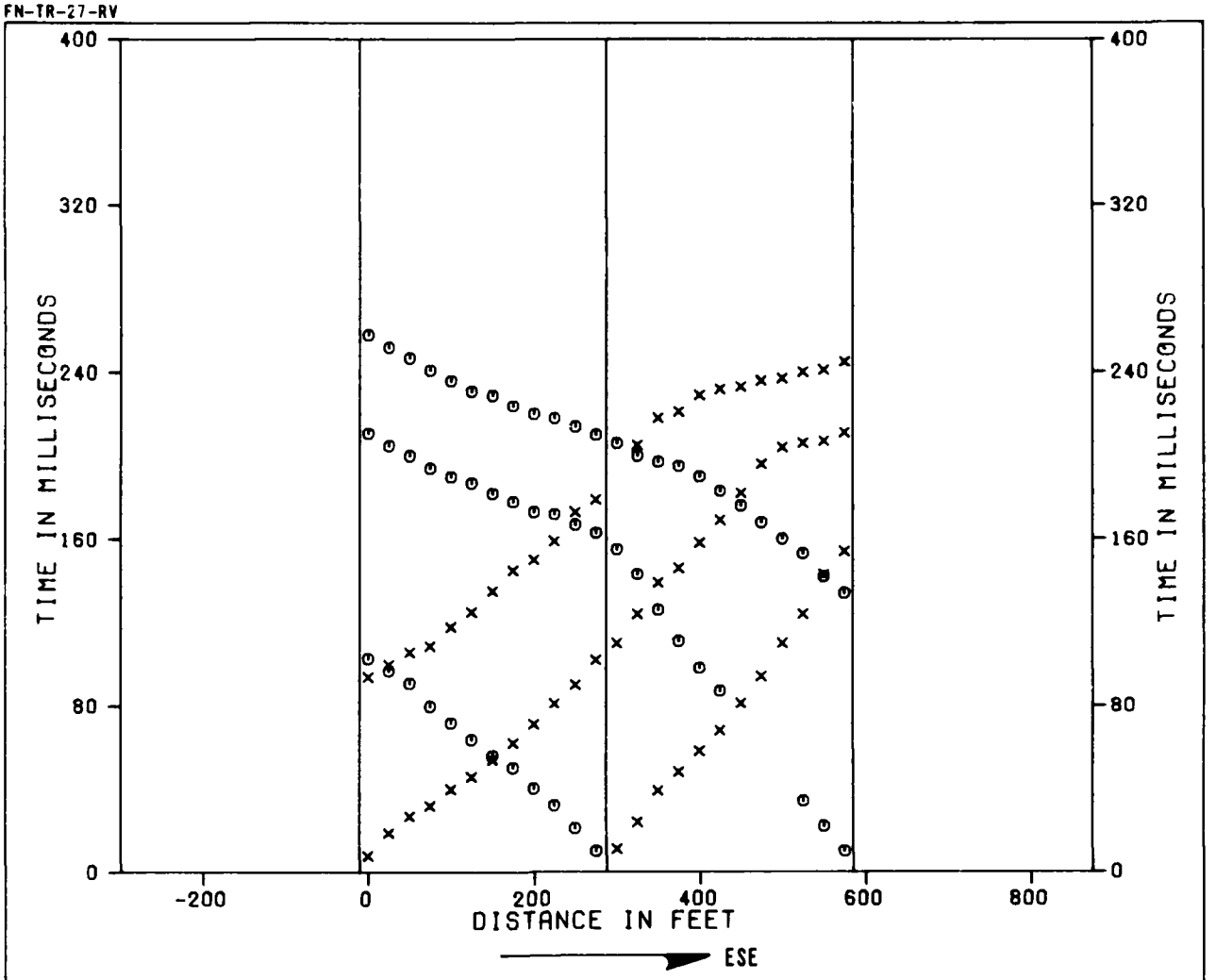
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

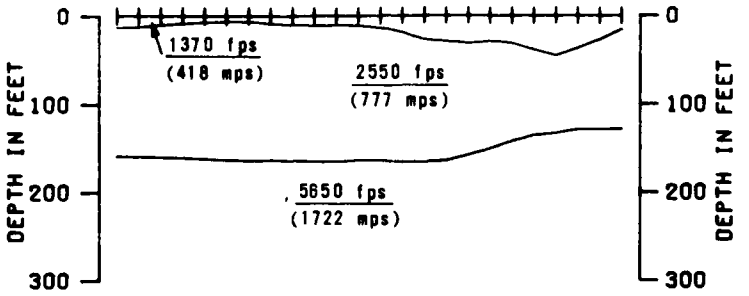
FIGURE
II-3-8

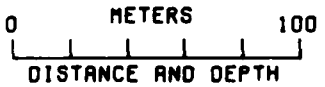
WOODWARD-CLYDE CONSULTANTS

15 JUN 80

FN-TR-27-RV







× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE RV-S-9
TIME-DISTANCE DATA AND VELOCITY PROFILE
RALSTON VALLEY, NEVADA

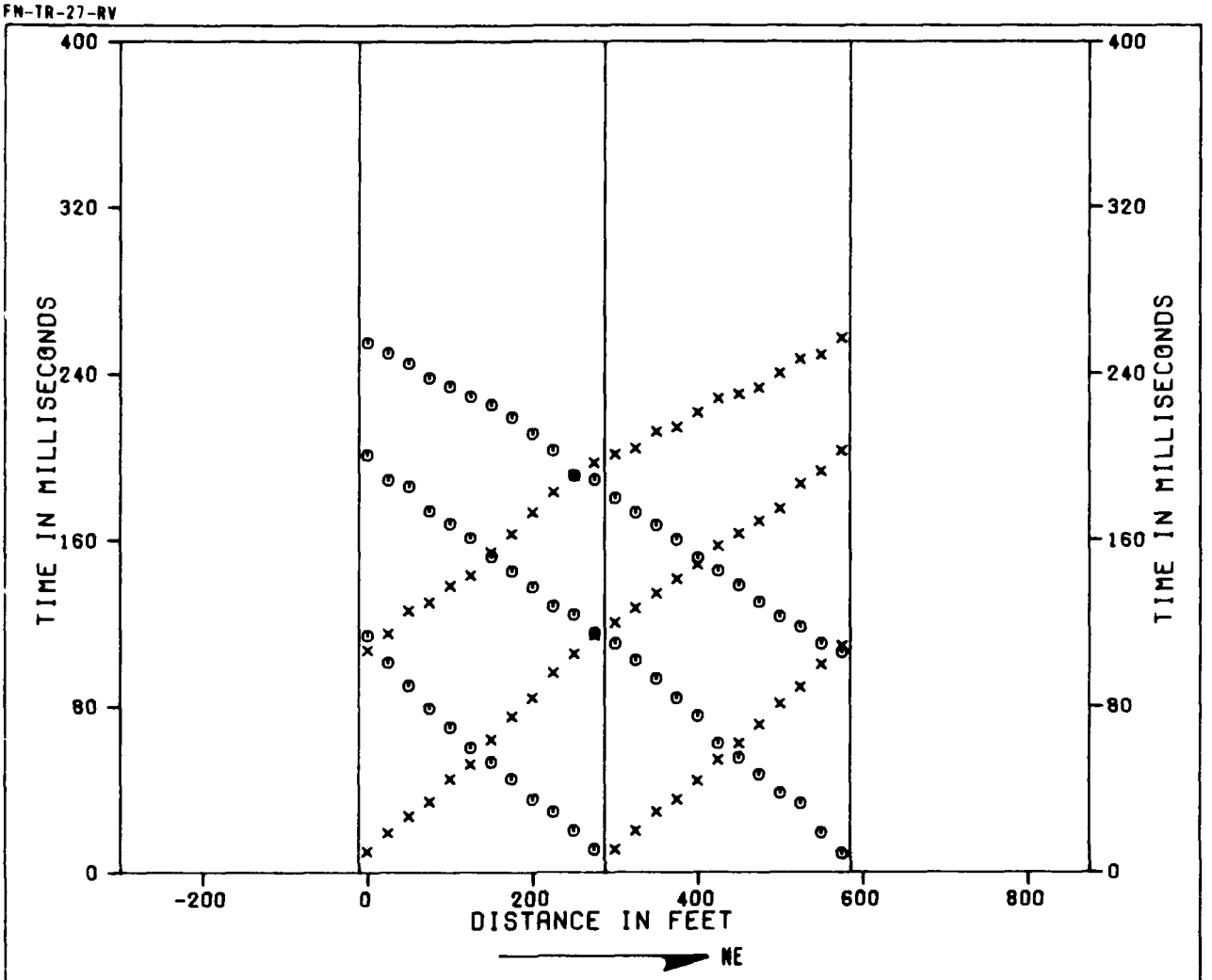
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

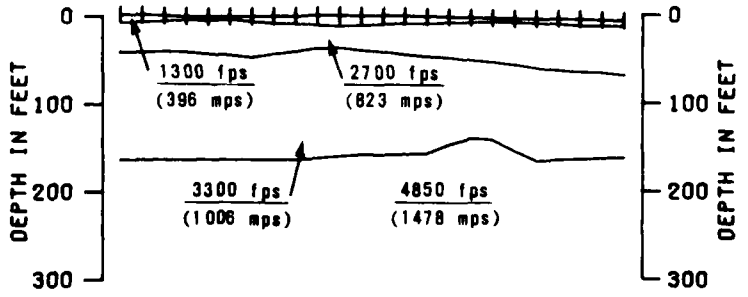
FIGURE
II-3-9

WOODWARD-CLYDE CONSULTANTS

15 JUN 80

FN-TR-27-RV





0 METERS 100

DISTANCE AND DEPTH

× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE RV-S-10
TIME-DISTANCE DATA AND VELOCITY PROFILE
RALSTON VALLEY, NEVADA

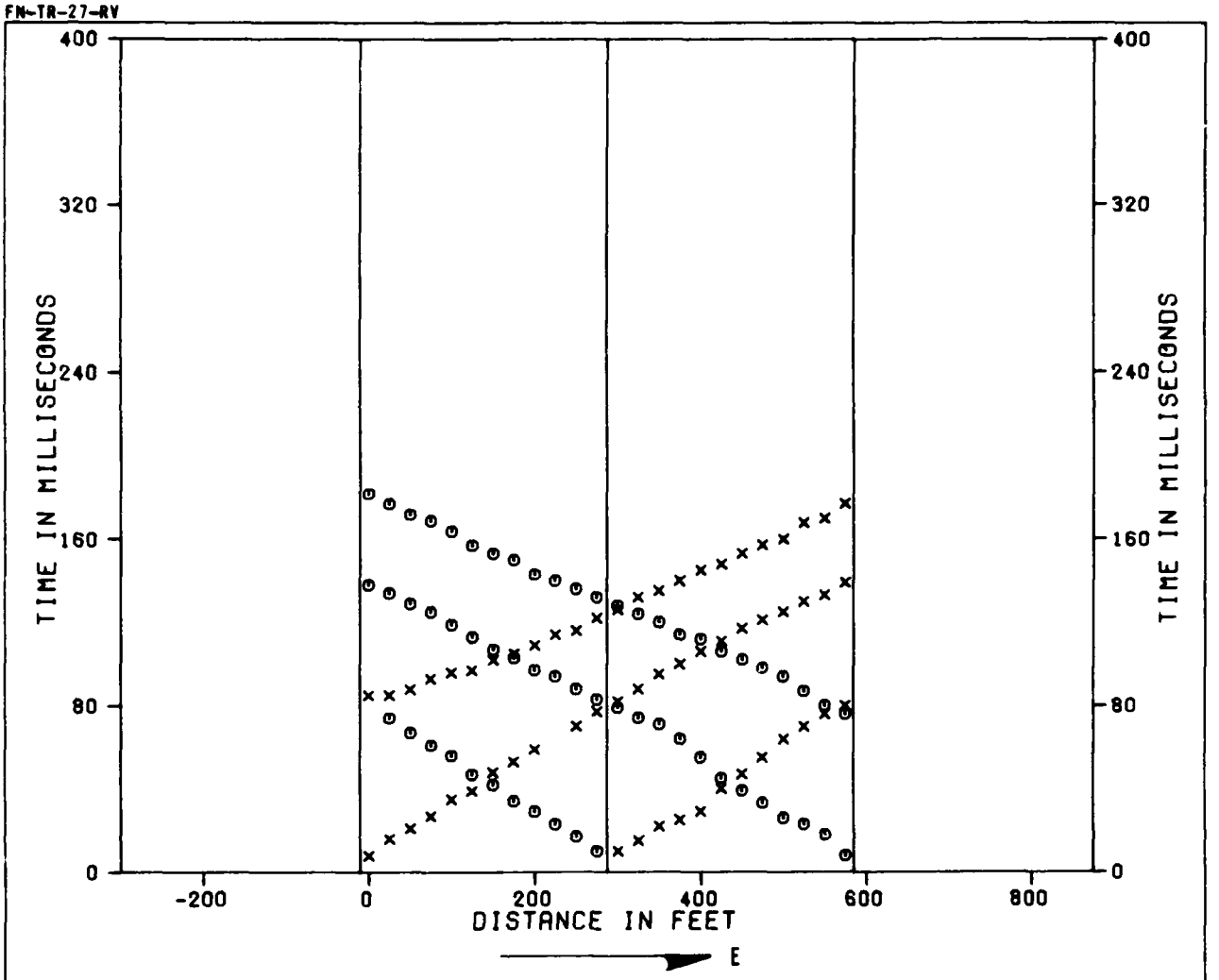
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

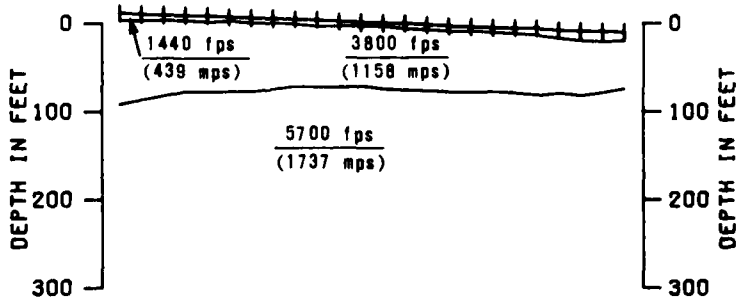
FIGURE
II-3-10

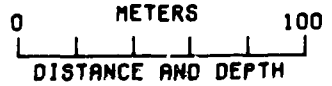
WOODWARD-CLYDE CONSULTANTS

15 JUN 80

FN-TR-27-RV







× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE RV-S-12
TIME-DISTANCE DATA AND VELOCITY PROFILE
RALSTON VALLEY, NEVADA

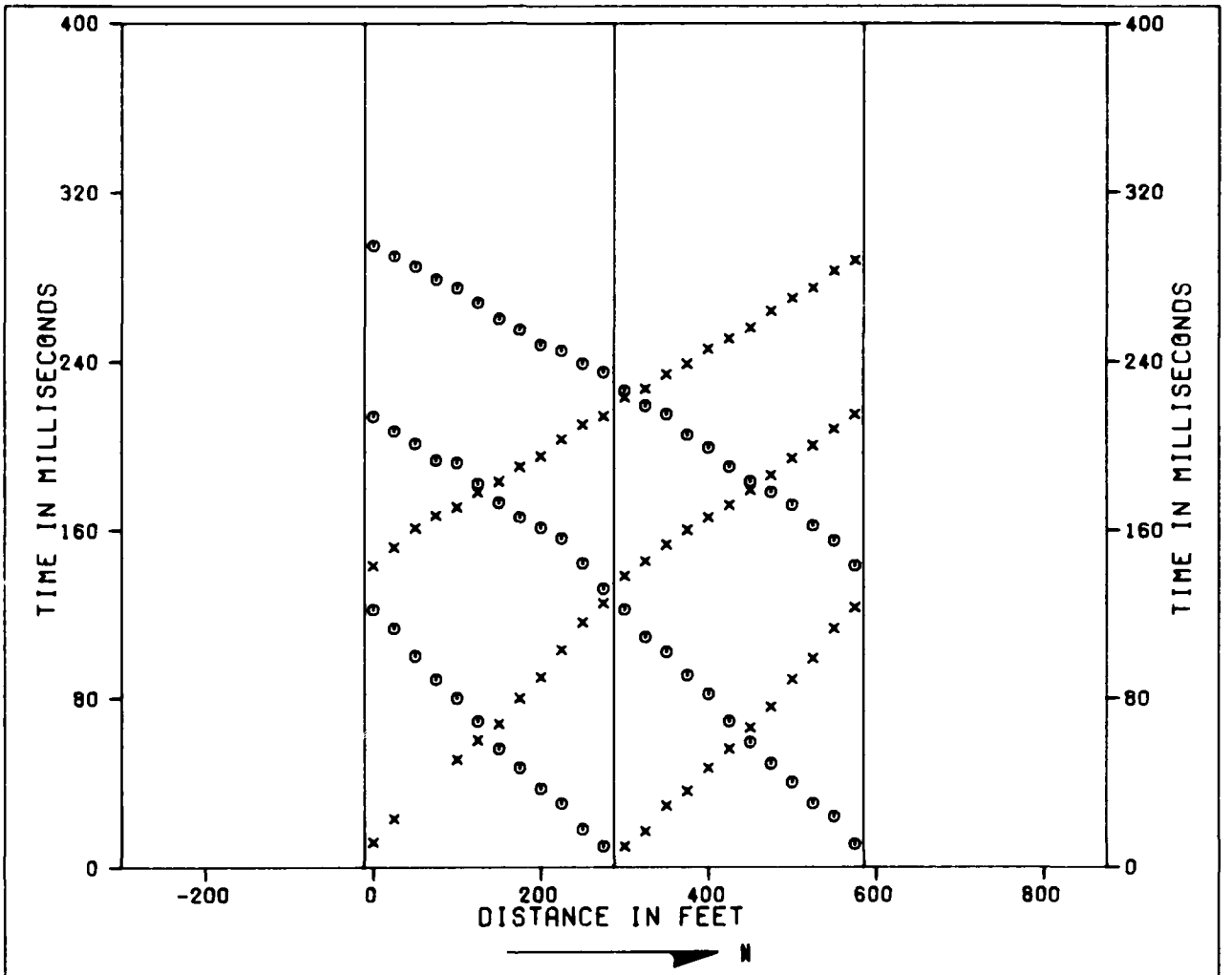
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

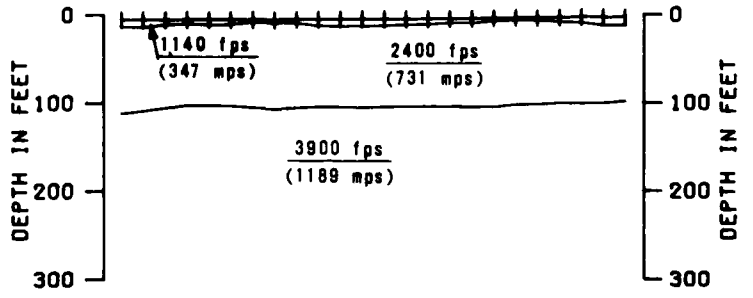
FIGURE
II-3-11

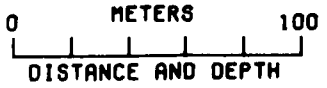
WOODWARD-NATIONAL, INC.

15 JUN 80

FN-TR-27-RV







× TIMES TO RIGHT OF SHOTS
⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE RV-S-13
TIME-DISTANCE DATA AND VELOCITY PROFILE
RALSTON VALLEY, NEVADA

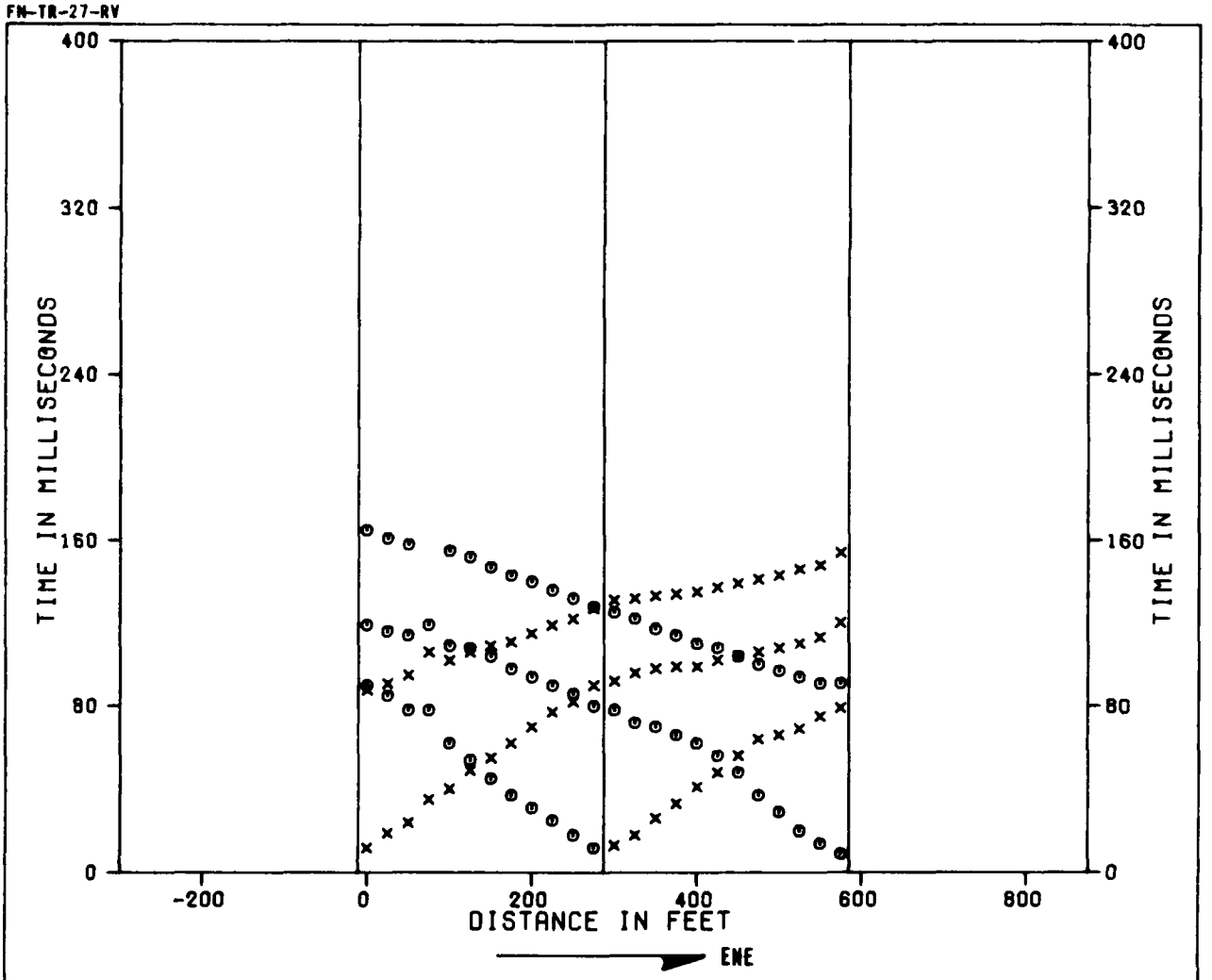
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

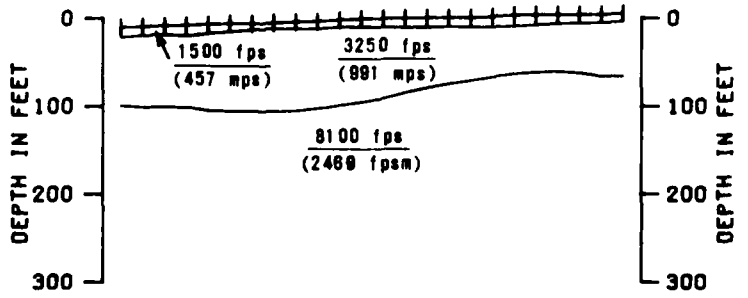
FIGURE
II-3-12

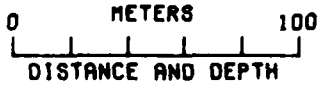
WOODWARD-NATIONAL RSCH.

15 JUN 80

FN-TR-27-RV







× TIMES TO RIGHT OF SHOTS
⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE RV-S-14
TIME-DISTANCE DATA AND VELOCITY PROFILE
RALSTON VALLEY, NEVADA

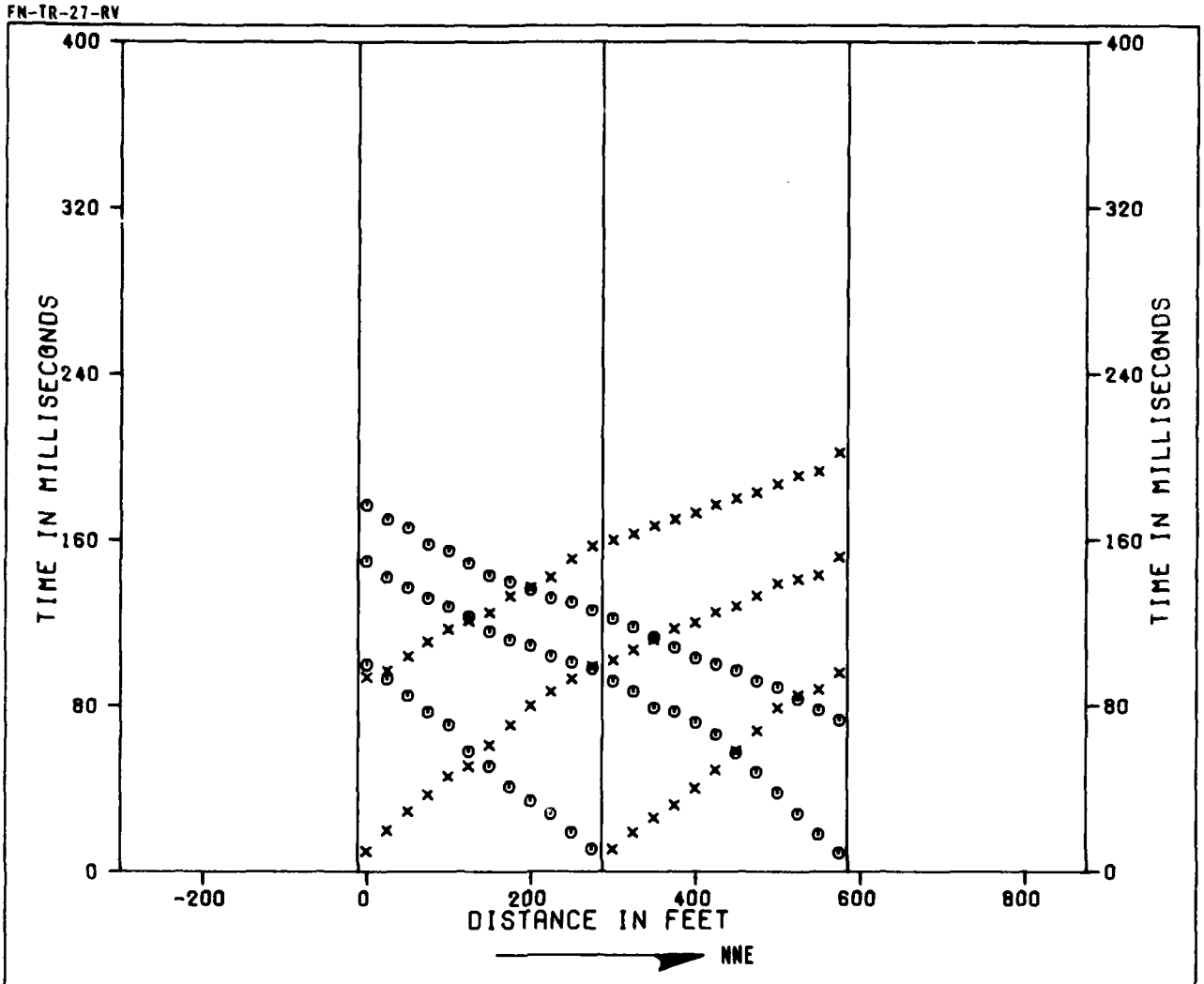
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE

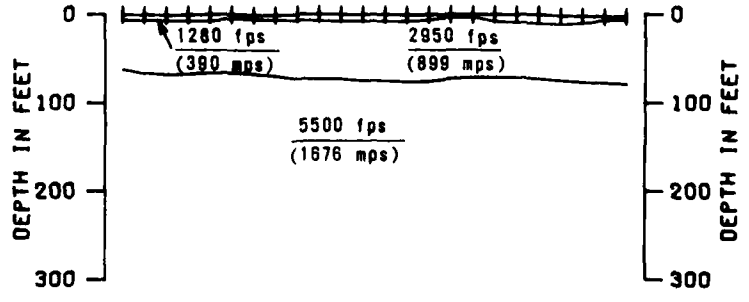
FIGURE
II-3-13

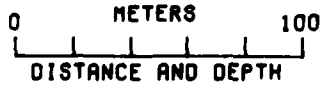
TERRA NATIONAL, INC.

15 JUN 80

FN-TR-27-RV







× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE RV-S-15
TIME-DISTANCE DATA AND VELOCITY PROFILE
RALSTON VALLEY, NEVADA

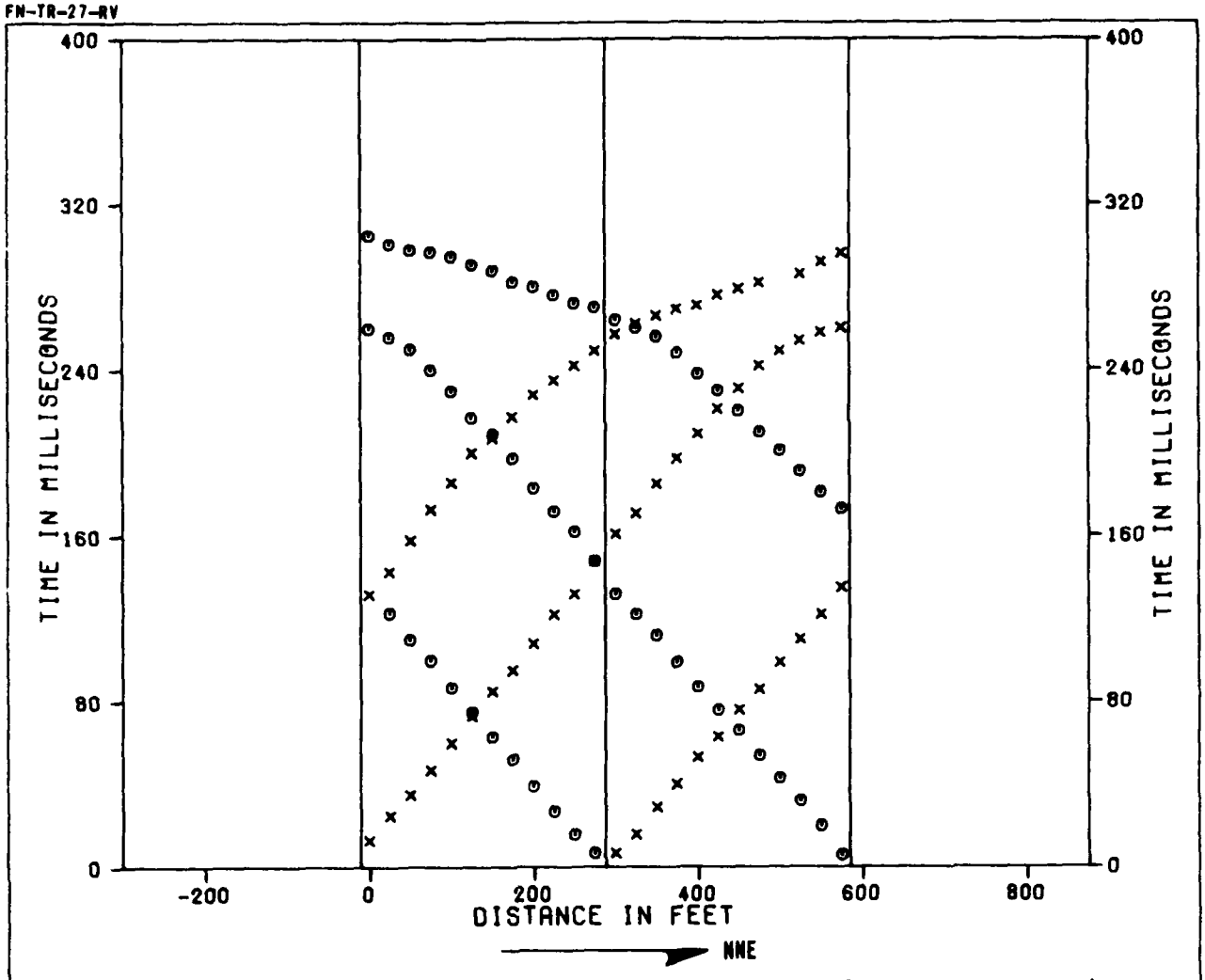
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

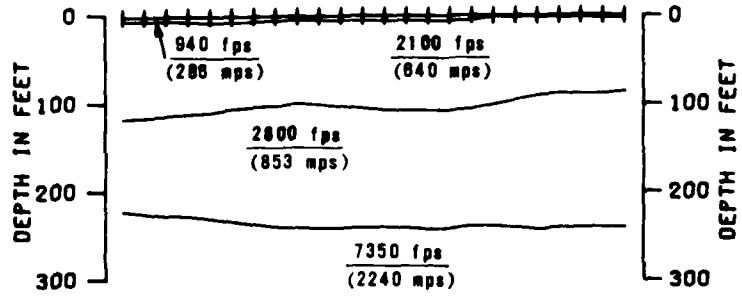
FIGURE
II-3-14

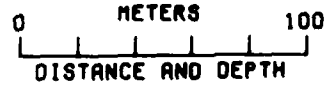
FUGRO NATIONAL, INC.

15 JUN 80

FN-TR-27-RV







× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

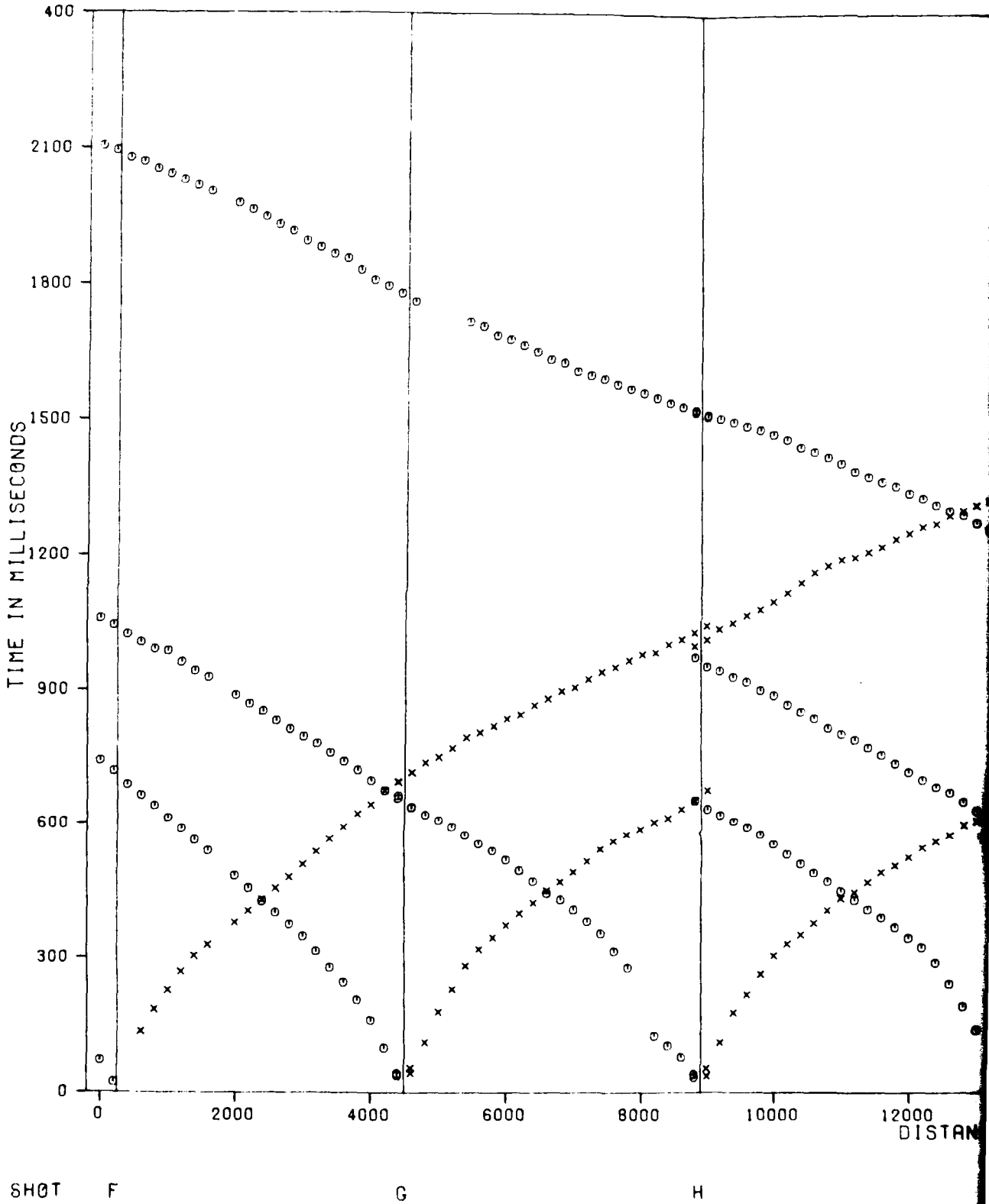
SEISMIC REFRACTION LINE RV-S-16
TIME-DISTANCE DATA AND VELOCITY PROFILE
RALSTON VALLEY, NEVADA

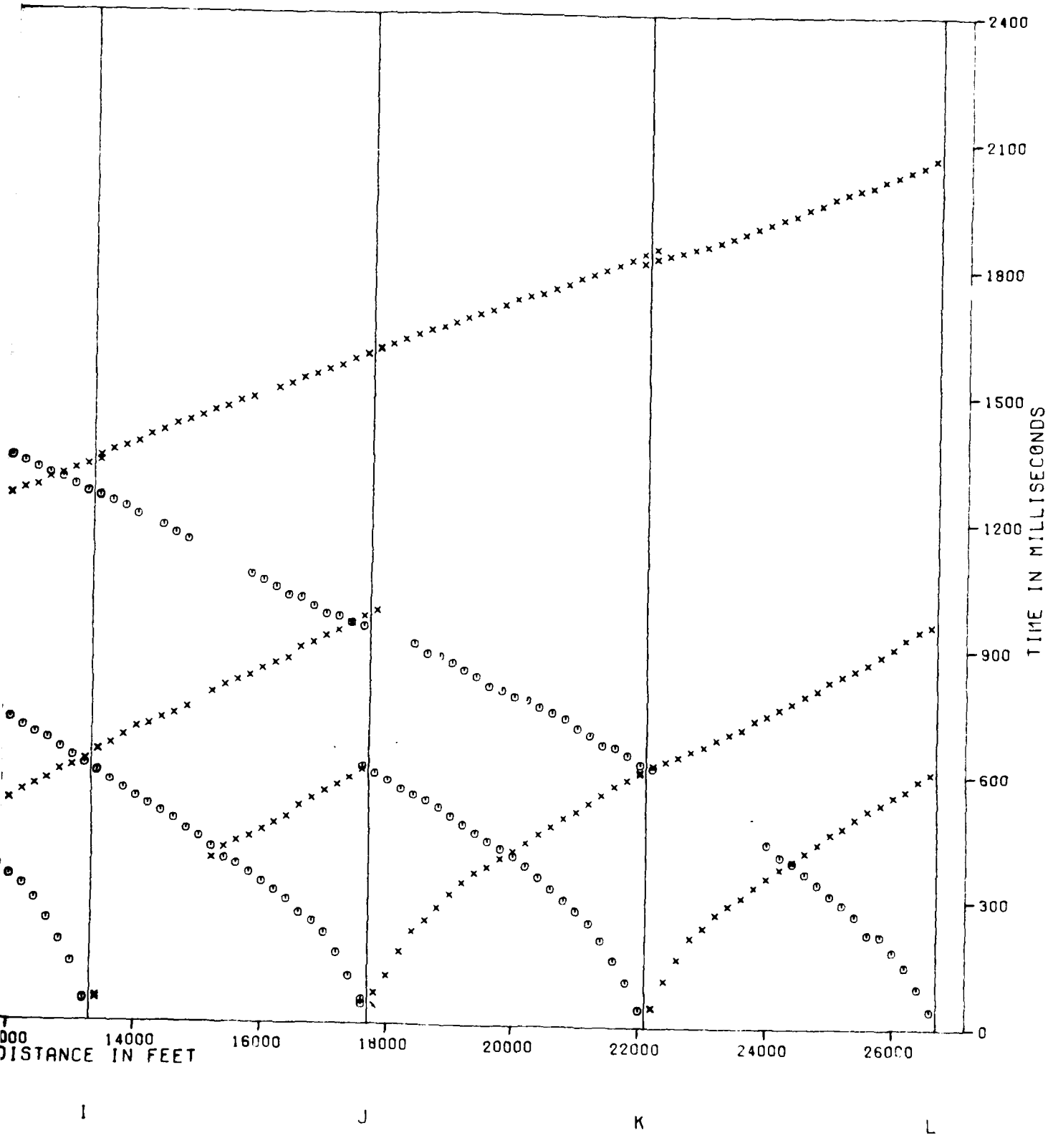
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE

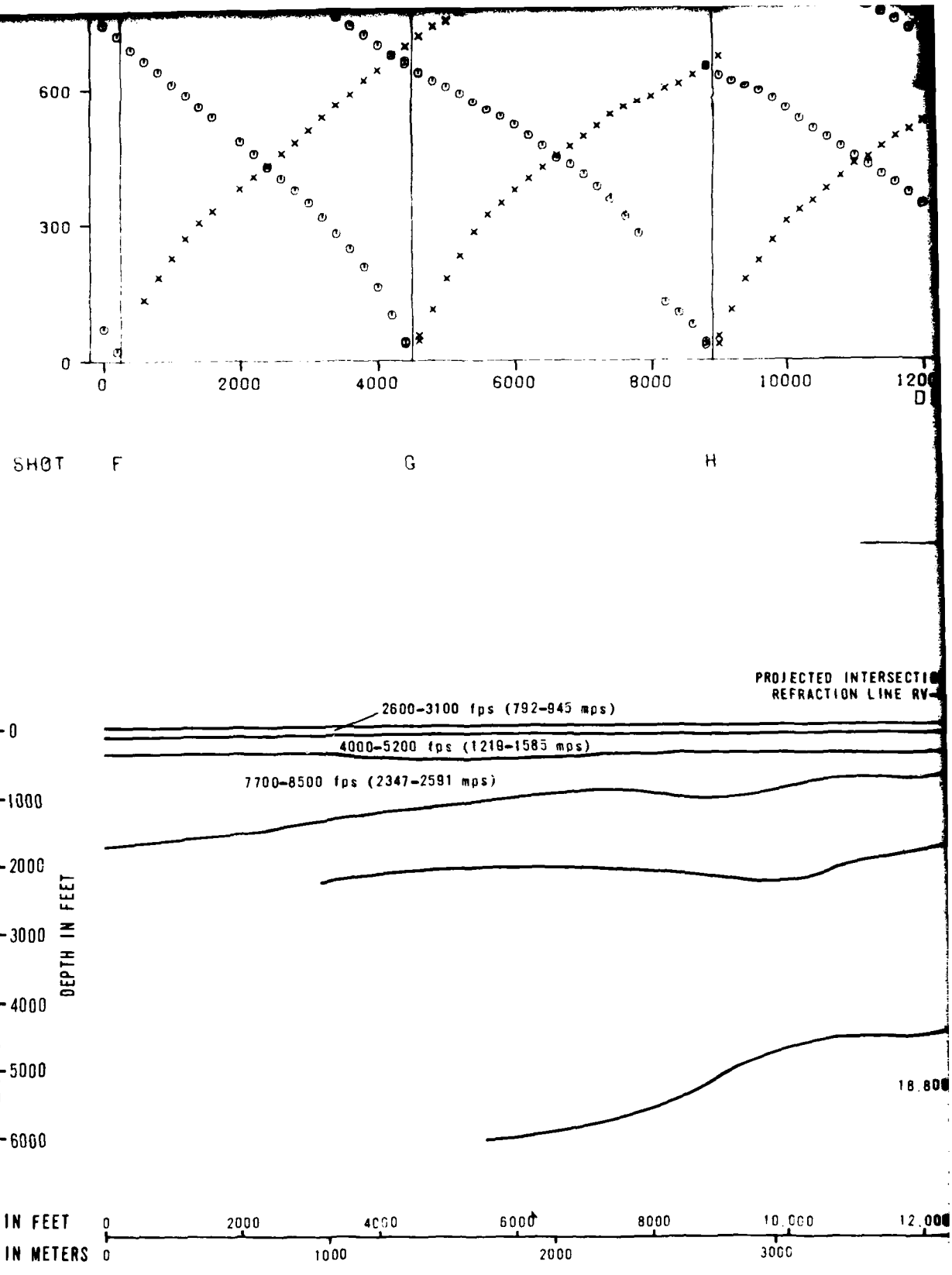
FIGURE
II-3-15

FUGRO NATIONAL, INC.

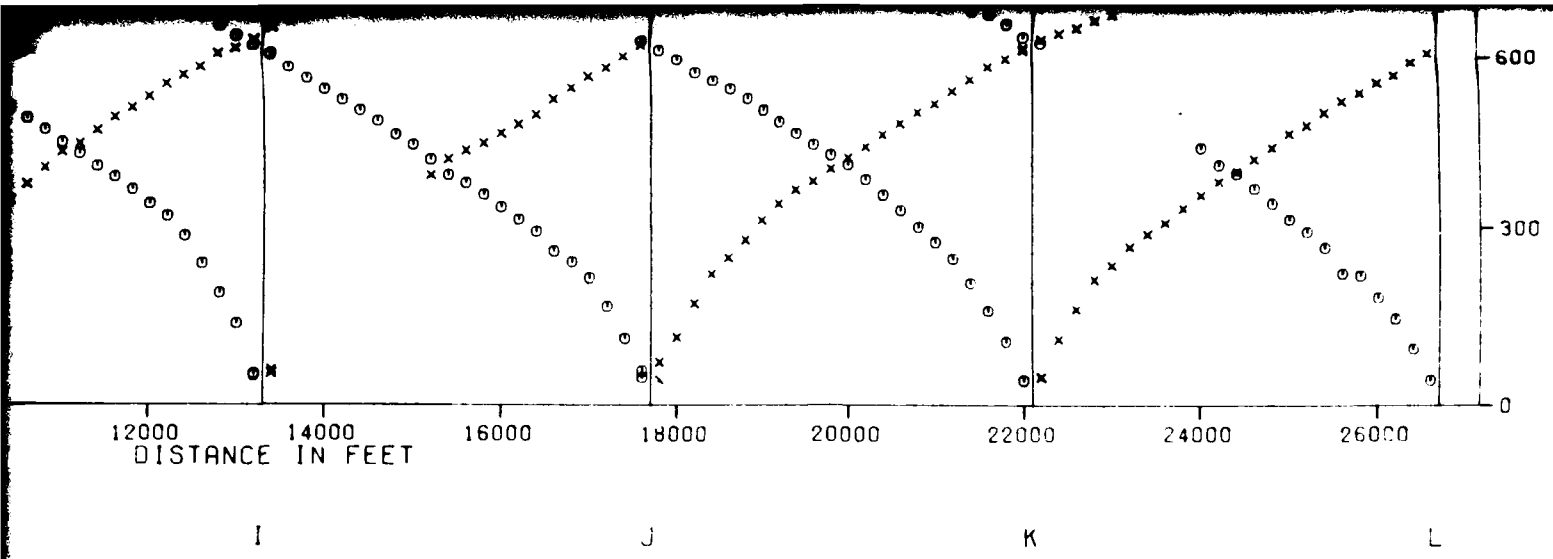
15 JUN 80


400
2100
1800
1500
1200
900
600
300
0
TIME IN MILLISECONDS
0
2000
4000
6000
8000
10000
12000
DISTAN
SHOT F
G
H


2400
2100
1800
1500
1200
900
600
300
0
TIME IN MILLISECONDS
000
14000
16000
18000
20000
22000
24000
26000
DISTANCE IN FEET
I
J
K
L
N


600
300
0
0
2000
4000
6000
8000
10000
SHOT F
G
H
PROJECTED INTERSECTI
REFRACTION LINE RV-
2600-3100 fps (792-945 mps)
4000-5200 fps (1219-1585 mps)
7700-8500 fps (2347-2591 mps)
18,800
DEPTH IN METERS
0
200
400
600
800
1000
1200
1400
1600
1800
DEPTH IN FEET
0
1000
2000
3000
4000
5000
6000
DISTANCE IN FEET
0
2000
4000
6000
8000
10,000
12,000
DISTANCE IN METERS
0
1000
2000
3000

15 JUN 80



I J K L

N

INTERSECTION WITH
TION LINE RV-DS-2

GROUND SURFACE

10,500-11,300 fps (3200-3444 mps)

13,300-13,800 fps (4054-4206 mps)

18,800 fps (5730 mps)

DEPTH IN FEET

0
1000
2000
3000
4000
5000
6000

12,000 14,000 16,000 18,000 20,000 22,000 24,000 26,000 28,000

4000 5000 6000 7000 8000

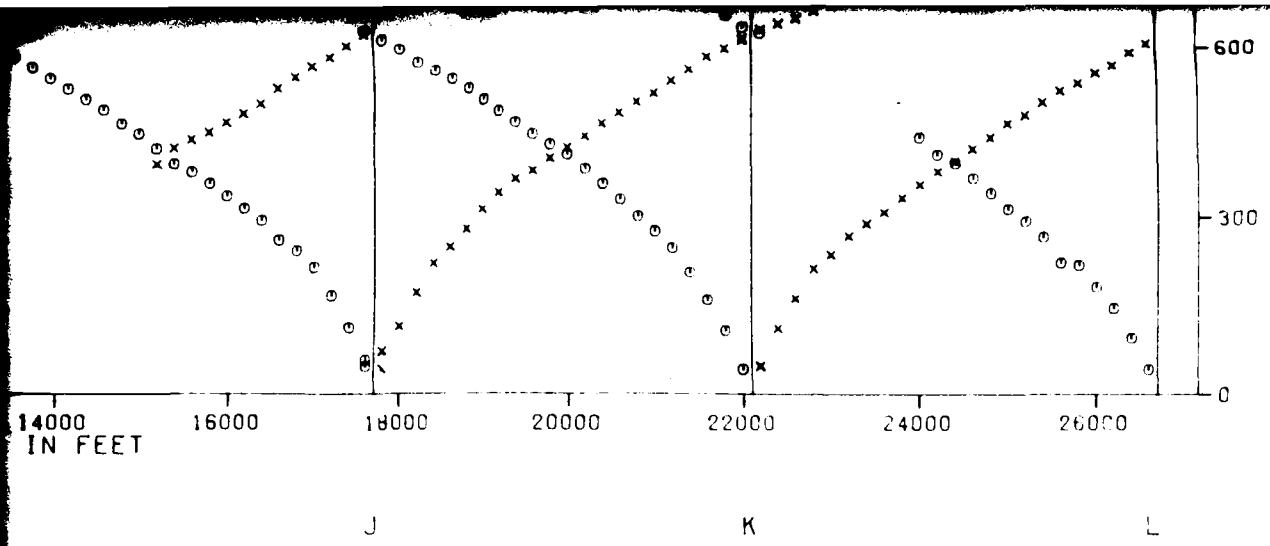
EXPLANATION

- ⊙ TIMES TO LEFT OF SHOTS
- × TIMES TO RIGHT OF SHOTS

SEISMIC REFRACTION LINE
TIME-DISTANCE DATA AND VELOC
RALSTON VALLEY, NEV

ME SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE

UGRO NATION



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GROUND SURFACE

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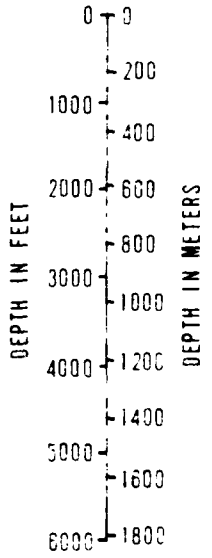

NATION

LEFT OF SHOTS

RIGHT OF SHOTS

SEISMIC REFRACTION LINE RV-DS-1
TIME-DISTANCE DATA AND VELOCITY PROFILE
RALSTON VALLEY, NEVADA

MINING INVESTIGATION
DEPARTMENT OF THE ARMY BMO

FIGURE
D-3-16

FUGRO NATIONAL, INC.

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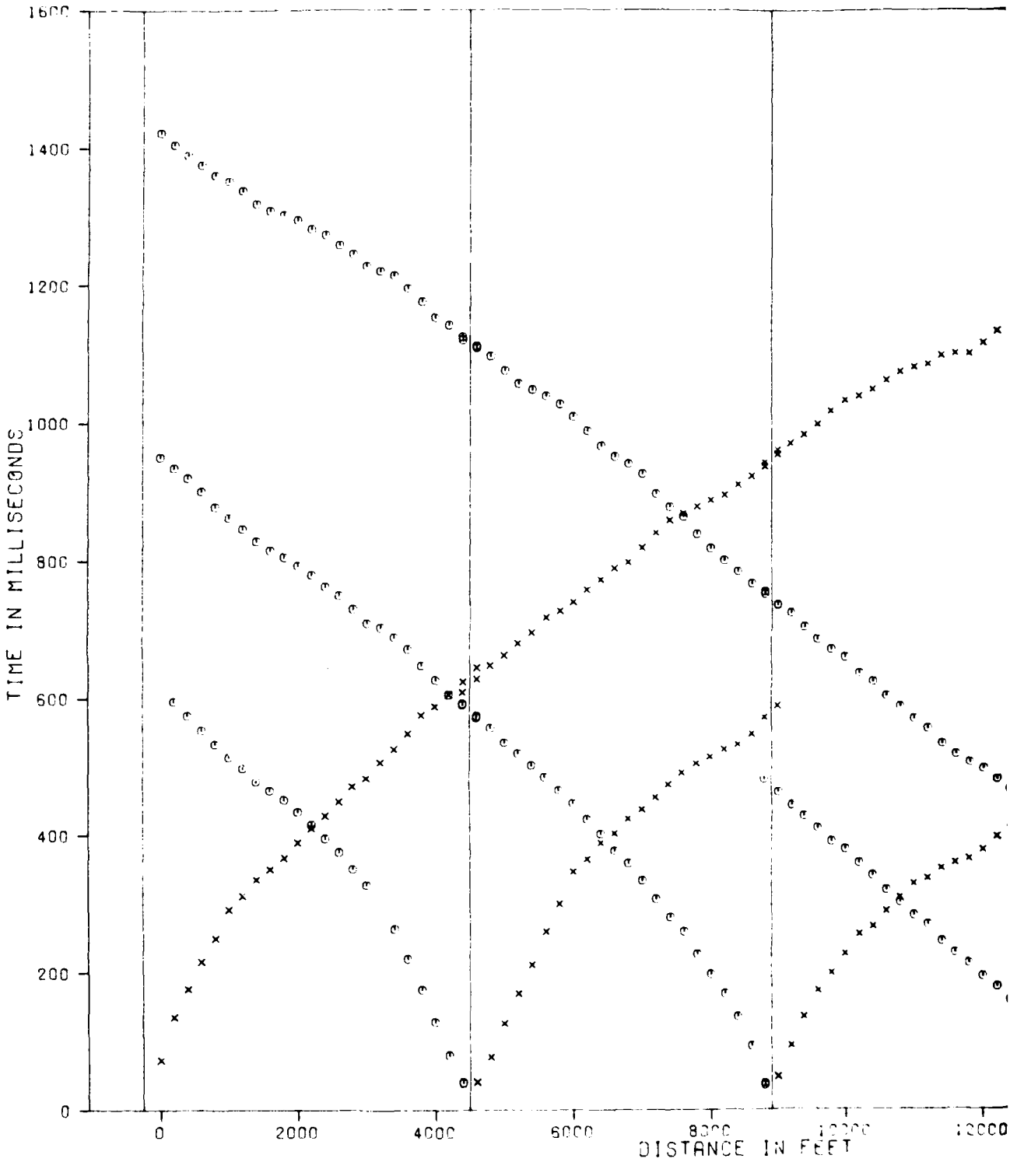
FN-TR-27-RV



SHOT F G H

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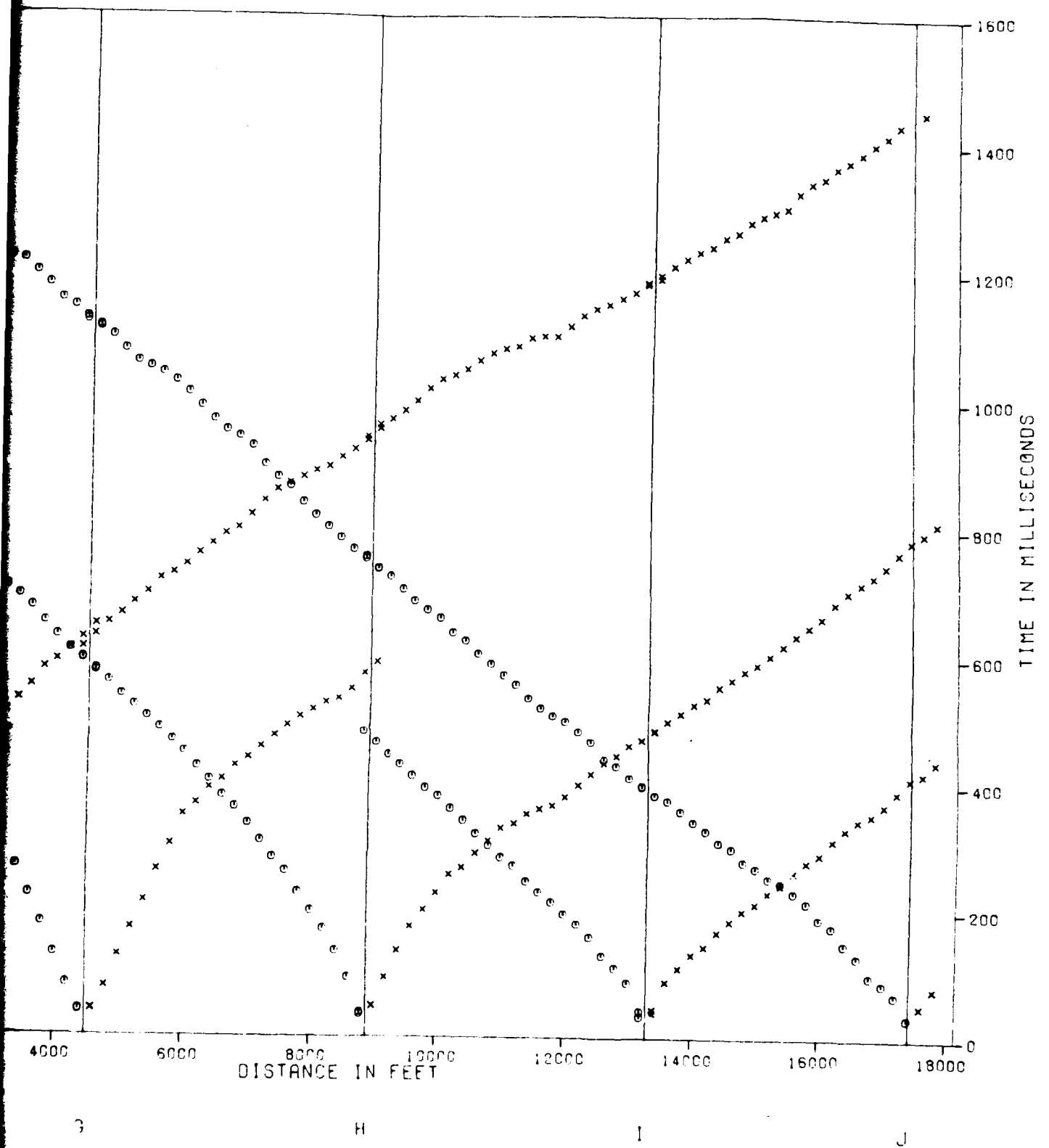
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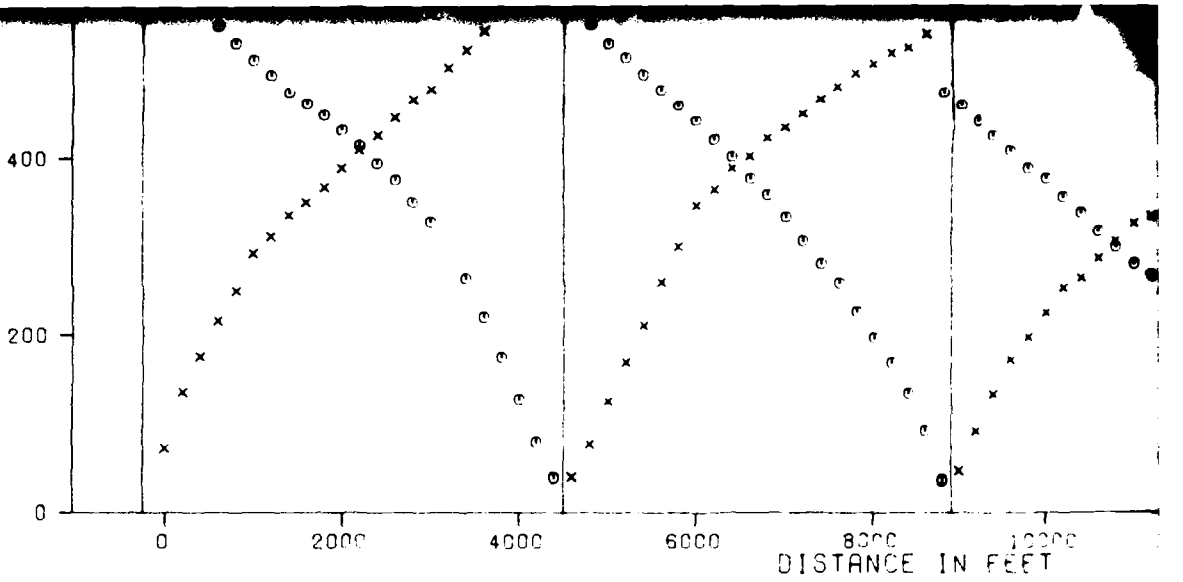
DISTANCE IN FEET

G H I J

ENE



SHOT F G H

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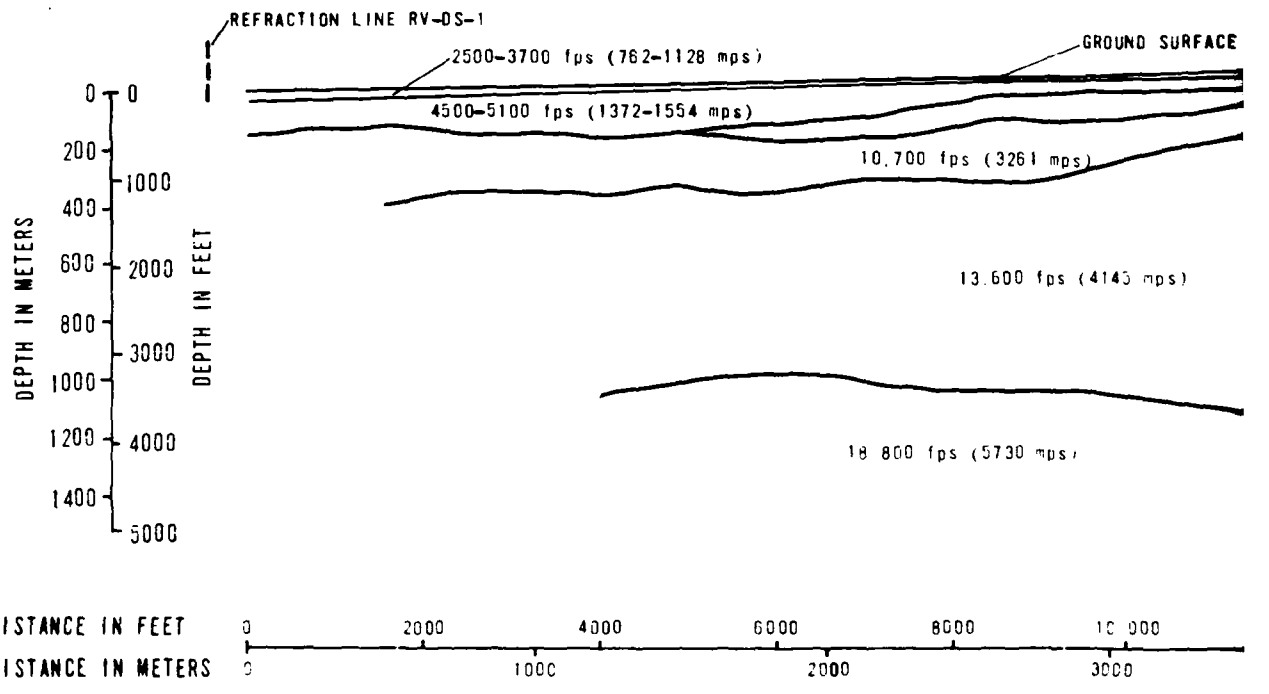
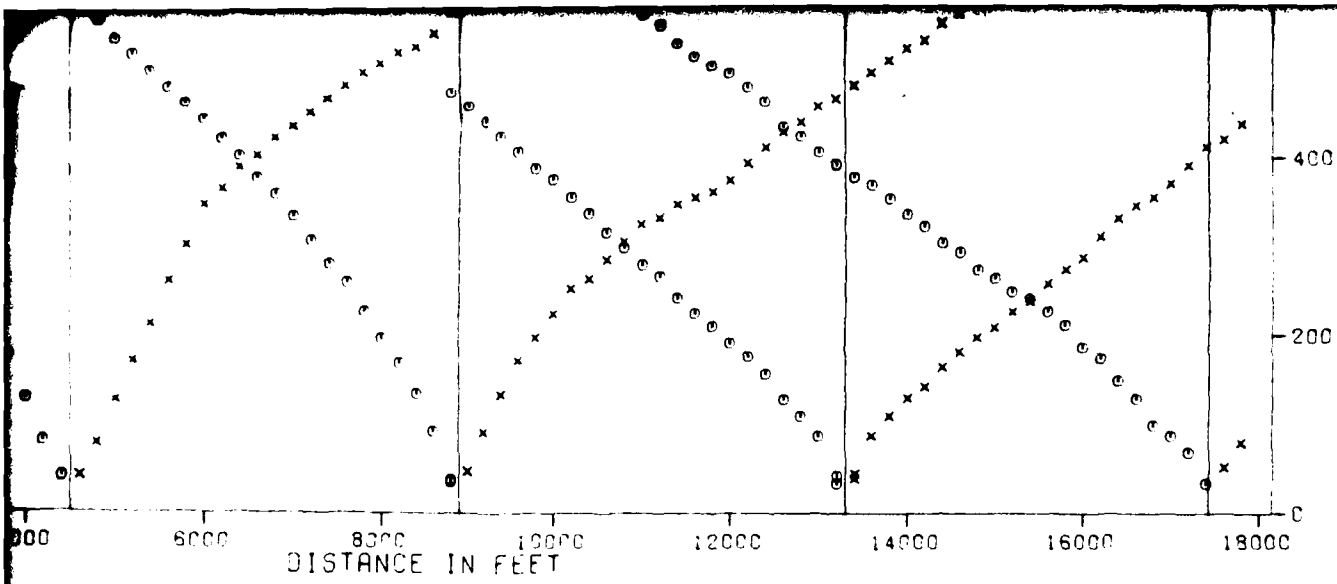


EXPLANATION

⊙ TIMES TO LEFT OF SHOTS

× TIMES TO RIGHT OF SHOTS

15 JUN 80



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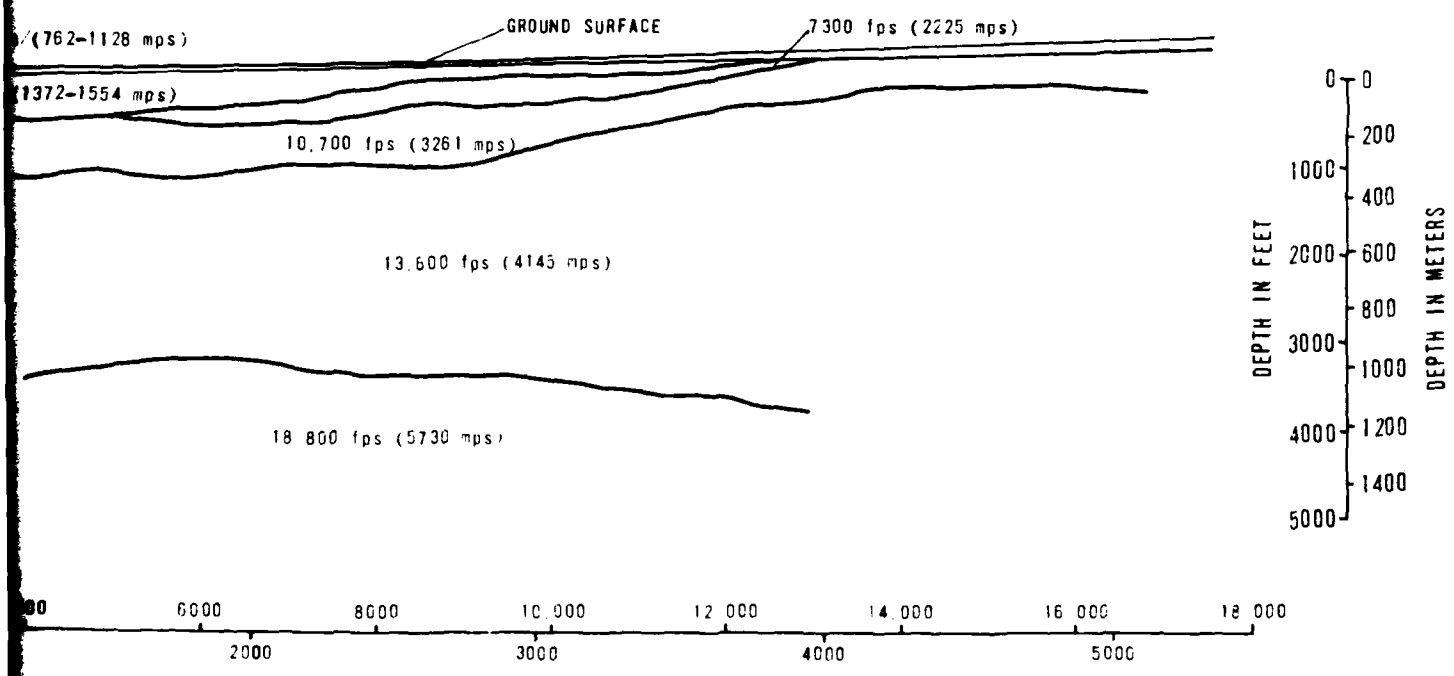

EXPLANATION

⊙ TIMES TO LEFT OF SHOTS

× TIMES TO RIGHT OF SHOTS

SEISMIC REFRACTION LINE RV-DS-2
TIME-DISTANCE DATA AND VELOCITY PROFILE
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-3-17

FUGRO NATIONAL, INC.

SECTION 4.0

BORING LOGS

4.0 EXPLANATIONS OF BORING AND TRENCH LOGS

Note: The boring scheduled for the location numbered RV-B-11 was not drilled.

All data from borings and trenches are presented on standard Fugro National logs in Sections 4.0 and 5.0. Explanations of the column headings on the logs are as follows:

A. Designations - Borings and trenches are identified as follows:

RV-B-1
RV - abbreviation for the site (e.g., RV-Ralston Valley)
B - abbreviation for activity (e.g., B-boring, T-trench)
1 - number of activity

B. Sample Type - Different sampling techniques were used and the symbols are explained at the bottom of the boring logs. For details of sampling techniques, see Section A5.0 of Appendix in Volume I. Horizontal lines, to scale, indicate the depth where sampling was attempted.

C. Percent Recovery - The numbers shown represent the ratio (in percent) of the soil sample recovered in the sampler to the full penetration of the sampler.

D. N Value - Corresponds to standard penetration resistance, which is number of blows required to drive a standard split-spoon sampler for the second and third of three 6-inch (15 cm) increments with a 140-pound (63.5 kg) hammer falling 30 inches (76 cm) (ASTM D 1586-67).

E. Depth - Corresponds to depth below ground surface in meters and feet.

F. Lithology - Graphic representation of the soil and rock types.

G. USCS - Unified Soil Classification System (see Table II-4-1 for complete details) symbols.

H. Soil Description - Except in cases where samples were classified based on laboratory test data, the descriptions are based on visual classification. The procedures outlined in ASTM D 2487-69, Classification of Soils for Engineering Purposes, and D 2488-69, Description of Soils (Visual-Manual Procedure) were followed. Solid lines across the column indicate known change in strata at the depth shown.

Definitions of some of the terms and criteria to describe soils and conditions encountered during the exploration follow.

Gradation : A coarse-grained soil is well graded if it has a wide range in grain size and substantial amounts of most intermediate particle sizes.

Poorly graded indicates that the soil consists predominantly of one size (uniformly graded) or has a wide range of sizes with some intermediate sizes obviously missing (gap-graded).

Moisture :

Dry	- no feel of moisture
Slightly Moist	- much less than normal moisture
Moist	- normal moisture for soil
Very Moist	- much greater than normal moisture
Wet	- for soils below the water table

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FN-TR-27-RV

UNIFIED SOIL CLASSIFICATION SYSTEM

TABLE II-4-1

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

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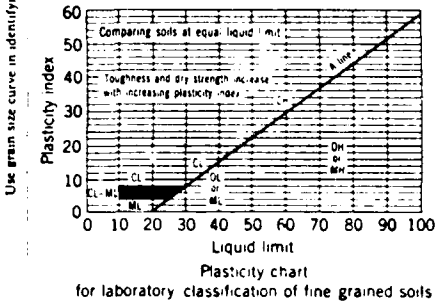
Field Identification Procedures (Excluding particles larger than 3 in. and basing fractions on estimated weights)						Group Symbols[a]	Typical Names	Information Required for Describing Soils	Laboratory Classification Criteria
Coarse-grained soils More than half of material is *larger* than No. 200 sieve size[b]	Gravels More than half of coarse fraction is larger than No 4 sieve size (For visual classification, the ¾ in. size may be used as equivalent to the No. 4 sieve size)	Clean gravels (little or no fines)		Wide range in grain size and substantial amounts of all intermediate particle sizes		*GW*	Well graded gravels, gravel-sand mixtures, little or no fines	Give typical name; indicate approximate percentages of sand and gravel, maximum size, angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information, and symbols in parentheses For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics Example: *Silty sand*, gravelly; about 20%, hard, angular gravel particles ½-in maximum size; rounded and subangular sand grains coarse to fine, about 15%, nonplastic fines with low dry strength; well compacted and moist in place; alluvial sand, (*SM*)	$C_U = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
				Predominantly one size or a range of sizes with some intermediate sizes missing		*GP*	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for *GW*
		Gravels with fines (appreciable amount of fines)		Nonplastic fines (for identification procedures see *ML* below)		*GM*	Silty gravels, poorly graded gravel-sand-silt mixtures		Atterberg limits below "A" line, or *PI* less than 4 / Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
				Plastic fines (for identification procedures, see *CL* below)		*GC*	Clayey gravels, poorly graded gravel-sand-clay mixtures		Atterberg limits above "A" line, with *PI* greater than 7
	Sands More than half of coarse fraction is smaller than No 4 sieve size	Clean sands (little or no fines)		Wide range in grain sizes and substantial amounts of all intermediate particle sizes		*SW*	Well graded sands, gravelly sands, little or no fines		$C_U = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
				Predominantly one size or a range of sizes with some intermediate sizes missing		*SP*	Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for *SW*
		Sands with fines (appreciable amount of fines)		Nonplastic fines (for identification procedures, see *ML* below)		*SM*	Silty sands, poorly graded sand-silt mixtures		Atterberg limits below "A" line or *PI* less than 4 / Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
				Plastic fines (for identification procedures, see *CL* below)		*SC*	Clayey sands, poorly graded sand-clay mixtures		Atterberg limits below "A" line with *PI* greater than 7
Identification Procedures on Fraction Smaller than No. 40 Sieve Size									
Fine-grained soils More than half of material is *smaller* than No. 200 sieve size (The No. 200 sieve size is about the smallest particle visible to naked eye)	Silts and clays liquid limit less than 50	Dry Strength (crushing characteristics)	Dilatancy (reaction to shaking)	Toughness (consistency near plastic limit)					Use grain size curve in identifying the fractions as given under field identification Determine percentages of gravel and sand from grain size curve Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse grained soils are classified as follows: Less than 5%: *GW, GP, SW, SP* More than 12%: *GM, GC, SM, SC* *Borderline* cases requiring use of dual symbols
		None to slight	Quick to slow	None		*ML*	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	Give typical name; indicate degree and character of plasticity, amount and maximum size of coarse grains; colour in wet condition, odour if any, local or geologic name, and other pertinent descriptive information, and symbol in parentheses For undisturbed soils add information on structure, stratification, consistency in undisturbed and remoulded states, moisture and drainage conditions Example: *Clayey silt*, brown; slightly plastic; small percentage of fine sand; numerous vertical root holes; firm and dry in place; loess; (*ML*)	
		Medium to high	None to very slow	Medium		*CL*	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
		Slight to medium	Slow	Slight		*OL*	Organic silts and organic silt-clays of low plasticity		
	Silts and clays liquid limit greater than 50	Slight to medium	Slow to none	Slight to medium		*MH*	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
		High to very high	None	High		*CH*	Inorganic clays of high plasticity, fat clays		
		Medium to high	None to very slow	Slight to medium		*OH*	Organic clays of medium to high plasticity		
Highly Organic Soils		Readily identified by colour, odour, spongy feel and frequently by fibrous texture				*Pt*	Peat and other highly organic soils		



Plasticity chart
for laboratory classification of fine grained soils

From Wagner, 1957.

[a] *Boundary classifications*. Soils possessing characteristics of two groups are designated by combinations of group symbols. For example *GW-GC*, well graded gravel-sand mixture with clay binder.

[b] All sieve sizes on this chart are U.S. standard.

Field Identification Procedure for Fine Grained Soils or Fractions

These procedures are to be performed on the minus No. 40 sieve size particles, approximately ½₆ in. For field classification purposes, screening is not intended, simply remove by hand the coarse particles that interfere with the tests

Dilatancy (Reaction to shaking):

After removing particles larger than No. 40 sieve size, prepare a pat of moist soil with a volume of about one-half cubic inch. Add enough water if necessary to make the soil soft but not sticky.

Place the pat in the open palm of one hand and shake horizontally, striking vigorously against the other hand several times. A positive reaction consists of the appearance of water on the surface of the pat which changes to a livery consistency and becomes glossy. When the sample is squeezed between the fingers, the water and gloss disappear from the surface, the pat stiffens and finally it cracks or crumbles. The rapidity of appearance of water during shaking and of its disappearance during squeezing assist in identifying the character of the fines in a soil.

Very fine clean sands give the quickest and most distinct reaction whereas a plastic clay has no reaction. Inorganic silts, such as a typical rock flour, show a moderately quick reaction.

Dry Strength (Crushing characteristics):

After removing particles larger than No. 40 sieve size, mould a pat of soil to the consistency of putty, adding water if necessary. Allow the pat to dry completely by oven, sun or air drying, and then test its strength by breaking and crumbling between the fingers. This strength is a measure of the character and quantity of the colloidal fraction contained in the soil. The dry strength increases with increasing plasticity.

High dry strength is characteristic for clays of the CH group. A typical inorganic silt possesses only very slight dry strength. Silty fine sands and silts have about the same slight dry strength, but can be distinguished by the feel when powdering the dried specimen. Fine sand feels gritty whereas a typical silt has the smooth feel of flour.

Toughness (Consistency near plastic limit)

After removing particles larger than the No. 40 sieve size, a specimen of soil about one-half inch cube in size is moulded to the consistency of putty. If too dry, water must be added and if sticky, the specimen should be spread out in a thin layer and allowed to lose some moisture by evaporation. Then the specimen is rolled out by hand on a smooth surface or between the palms into a thread about one-eight inch in diameter. The thread is then folded and re-rolled repeatedly. During this manipulation the moisture content is gradually reduced and the specimen stiffens, finally loses its plasticity, and crumbles when the plastic limit is reached.

After the thread crumbles, the pieces should be lumped together and a slight kneading action continued until the lump crumbles.

The tougher the thread near the plastic limit and the stiffer the lump when it finally crumbles, the more potent is the colloidal clay fraction in the soil. Weakness of the thread at the plastic limit and quick loss of coherence of the lump below the plastic limit indicate either inorganic clay of low plasticity, or materials such as kaolin-type clays and organic clays which occur below the A-line.

Highly organic clays have a very weak and spongy feel at the plastic limit.

Consistency: Consistency descriptions of coarse-grained soils (GW, GP, GM, GC, SW, SP, SM, SC) are as follows.

Consistency	N Value (ASTM D 1586-67)
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	>50

Consistency descriptions of fine-grained soils (ML, CL, MH, CH,) are as follows:

Consistency	Shear Strength (ksf)	Shear Strength (kn/m^2)	Field Guide
Very Soft	0.25	12	Sample with height equal to twice the diameter, sags under own weight
Soft	0.25-0.50	12 - 24	Can be squeezed between thumb and forefinger
Firm	0.50-1.00	24-48	Can be molded easily with fingers
Stiff	1.00-2.00	48-96	Can be imprinted with slight pressure from fingers
Very Stiff	2.00-4.00	96-192	Can be imprinted with considerable pressure from fingers
Hard	over 4.00	over 192	Cannot be imprinted by fingers

Grain Shape: Angular - particles have sharp edges and relatively plane sides with unpolished surfaces.

Plasticity : Plasticity index is the range of water content, expressed as a percentage of the weight of the oven-dried soil, through which the soil is plastic. It is defined as the liquid limit minus the plastic limit. Descriptive ranges used on the logs include:

Nonplastic	(PI, 0 - 4)
Slightly Plastic	(PI, 4 - 15)
Medium Plastic	(PI, 15 - 30)
Highly Plastic	(PI, >30)

Cobbles and Boulders : A cobble is a rock fragment, usually rounded by weathering or abrasion, with an average diameter ranging between 3 and 12 inches (8 and 30 cm).

A boulder is a rock fragment, usually rounded by weathering or abrasion, with an average diameter of 12 inches (30 cm) or more.

I. Remarks - This column was provided on boring and trench logs for comments regarding drilling difficulty, number and size of cobbles or boulders encountered, loss of drilling fluid in the boring, trench wall stability, and other conditions encountered during drilling and excavations.

J. Dry Density and Moisture Content - The boring logs include a graphical display of laboratory test results for dry density (ASTM D 2937-71) in pounds per cubic foot and kilograms per cubic meter and moisture content (ASTM D 2216-71) in percent from representative samples taken during drilling. The symbols are explained at the bottom of the boring logs.

K. Sieve Analysis - The numbers represent the percentage by dry weight (ASTM D 422-63) of each of the following soil components:

GR - Gravel, rock particles that will pass a 3-inch (76 mm) sieve and are retained on No. 4 (4.75 mm) sieve.

SA - Sand, soil particles passing No. 4 sieve and retained on No. 200 (0.075 mm) sieve.

FI - Fines, silt or clay, soil particles passing No. 200 sieve.

L. Atterberg Limits (LL and PI) -

LL - Liquid Limit, the water content corresponding to the arbitrary limit between the liquid and plastic states of consistency of a soil (ASTM D 423-66).

PL - Plastic Limit, the water content corresponding to an arbitrary limit between the plastic and the semisolid state of consistency of a soil (ASTM D 424-59).

PI - Plasticity Index, numerical difference between the liquid limit (LL) and the plastic limit (PL) indicating the range of moisture content within which a soil-water mixture is plastic.

NP - Nonplastic.

M. Miscellaneous Information -

Elevations - indicated elevations on the logs are estimated from topographic maps of the study area, within an accuracy of half the contour interval.

Surficial Geologic Unit - indicates the surficial geologic unit in which the activity is located.

Date Drilled - indicates the period from beginning to completion of the activity.

Drilling Method - signifies the type of drilling procedure used such as rotary wash.

Hole Diameter - nominal size of boring drilled.

Water Level - indicates depth from ground surface to water table where encountered.

Trench Length - length at ground surface of final trench excavation.

Trench Orientation - bearing of longitudinal trench centerline.

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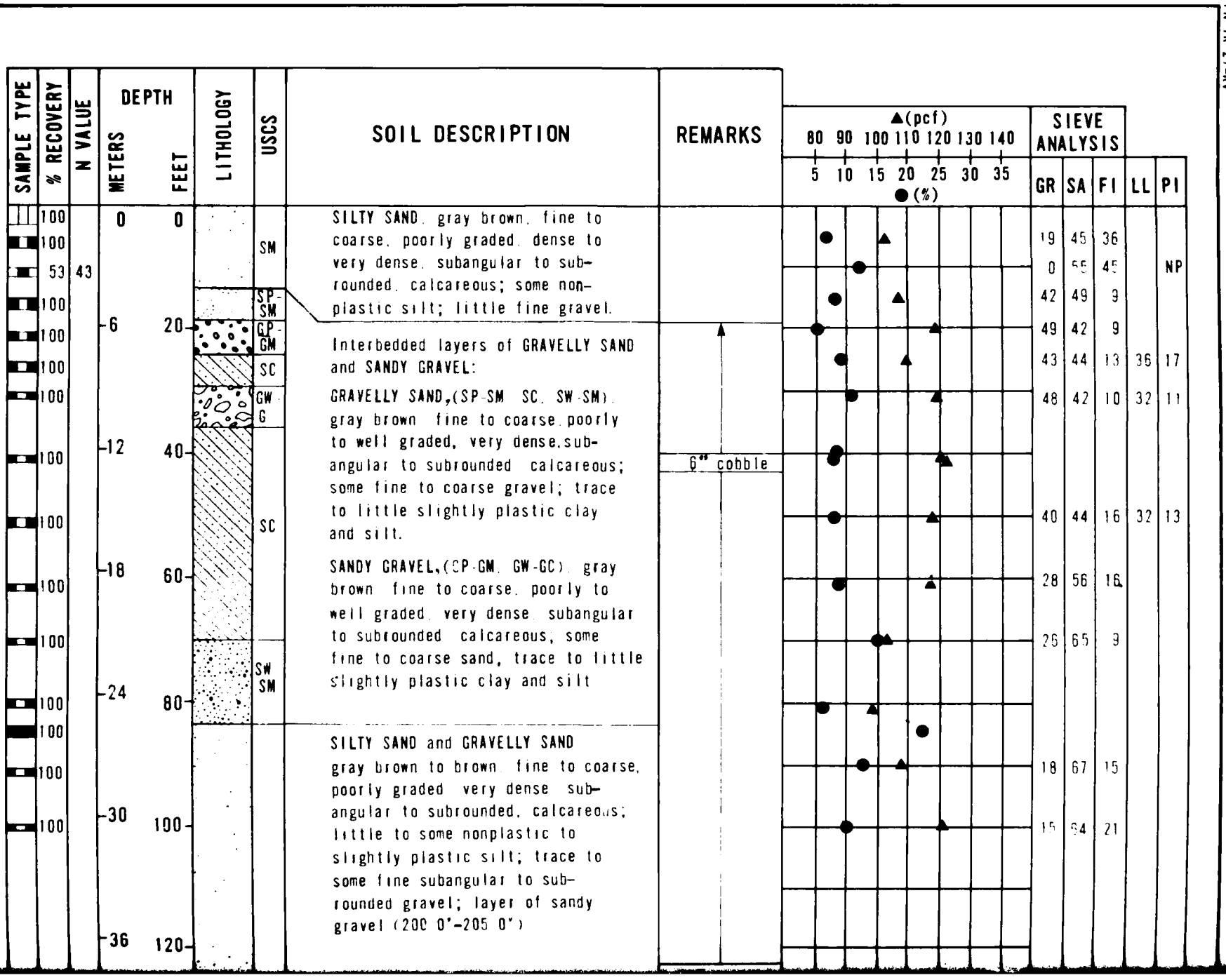

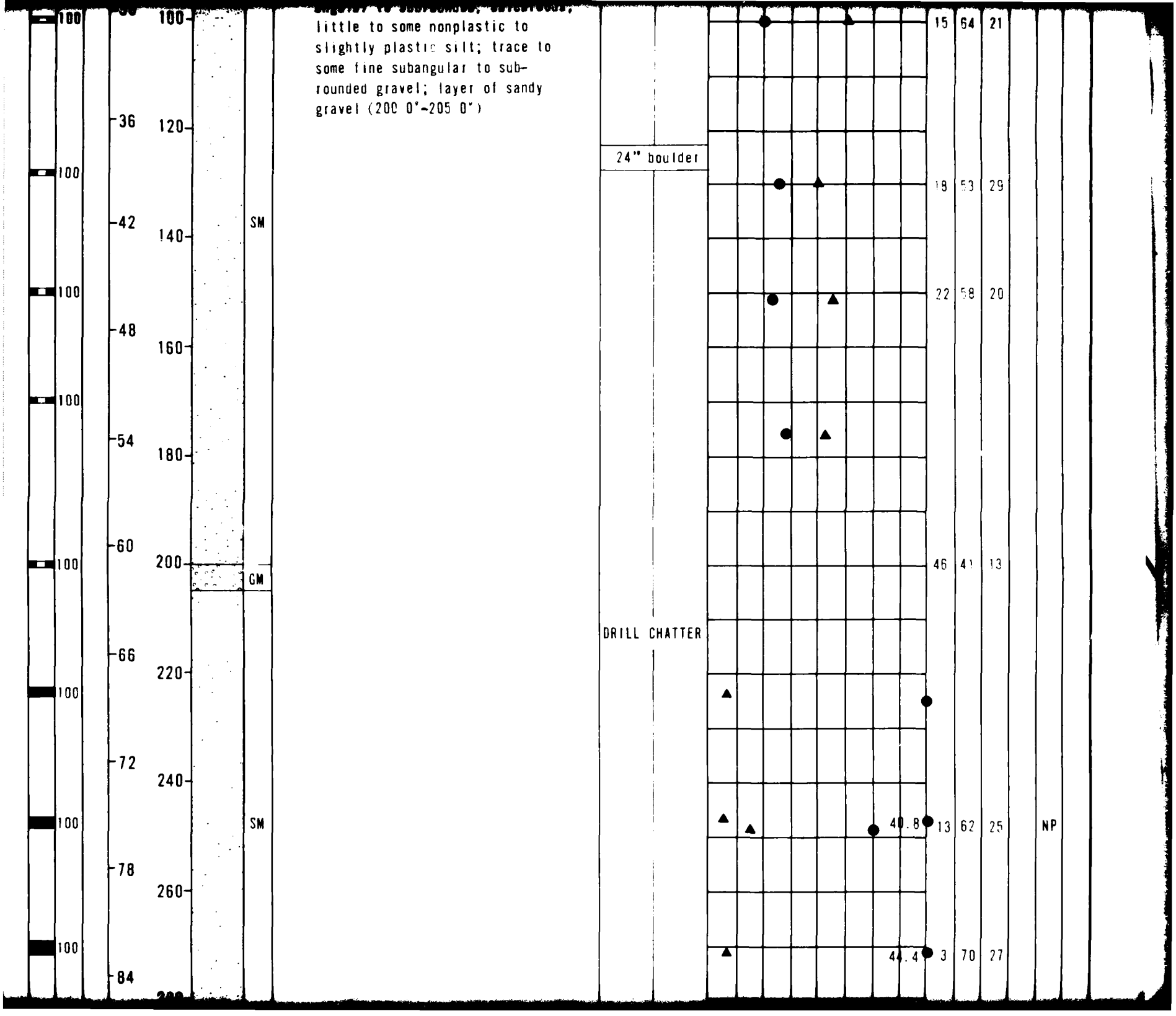
little to some nonplastic to slightly plastic silt; trace to some fine subangular to subrounded gravel; layer of sandy gravel (200 0'-205 0')
24" boulder
DRILL CHATTER
SM
GM
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100
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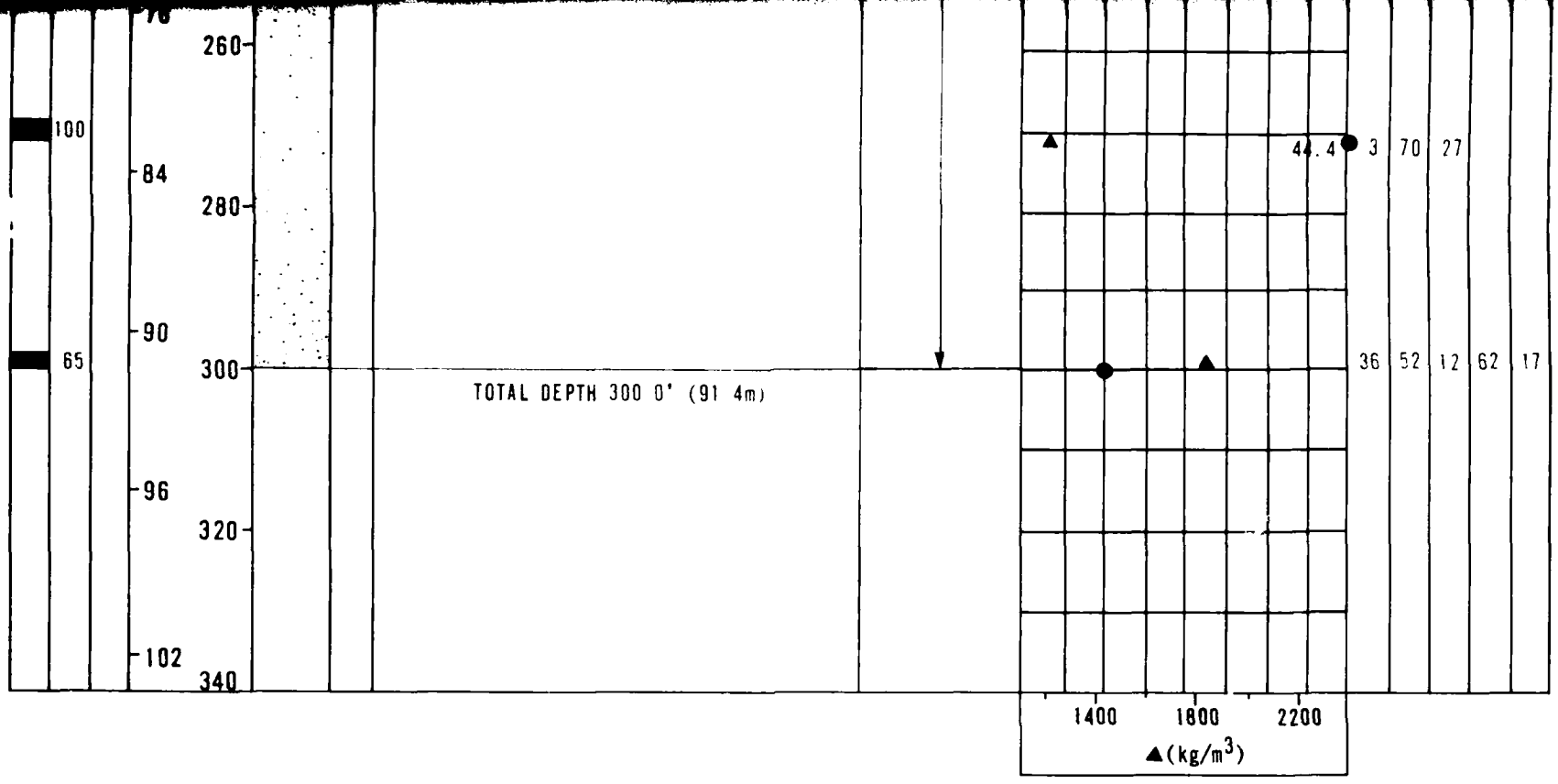

EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N - STANDARD PENETRATION RESISTANCE
- ▲ - DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● - MOISTURE CONTENT (ASTM: D-2216-71)
- NR - NO RECOVERY

BORING DETAILS

ELEVATION	:5610' (1710m)
SURFICIAL GEOLOGIC UNIT	:A5y
DATE DRILLED	:6-8 August 1977
DRILLING METHOD	:Rotary Wash
HOLE DIAMETER	:4 7/8" (124mm)
WATER LEVEL	:221' (67 4m)

FUGRO NATIONAL, INC.

MX SITING INVESTIGATION
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LOG OF BORING RV-B-1
RALSTON VALLEY, NEVADA

FIGURE II-4-1

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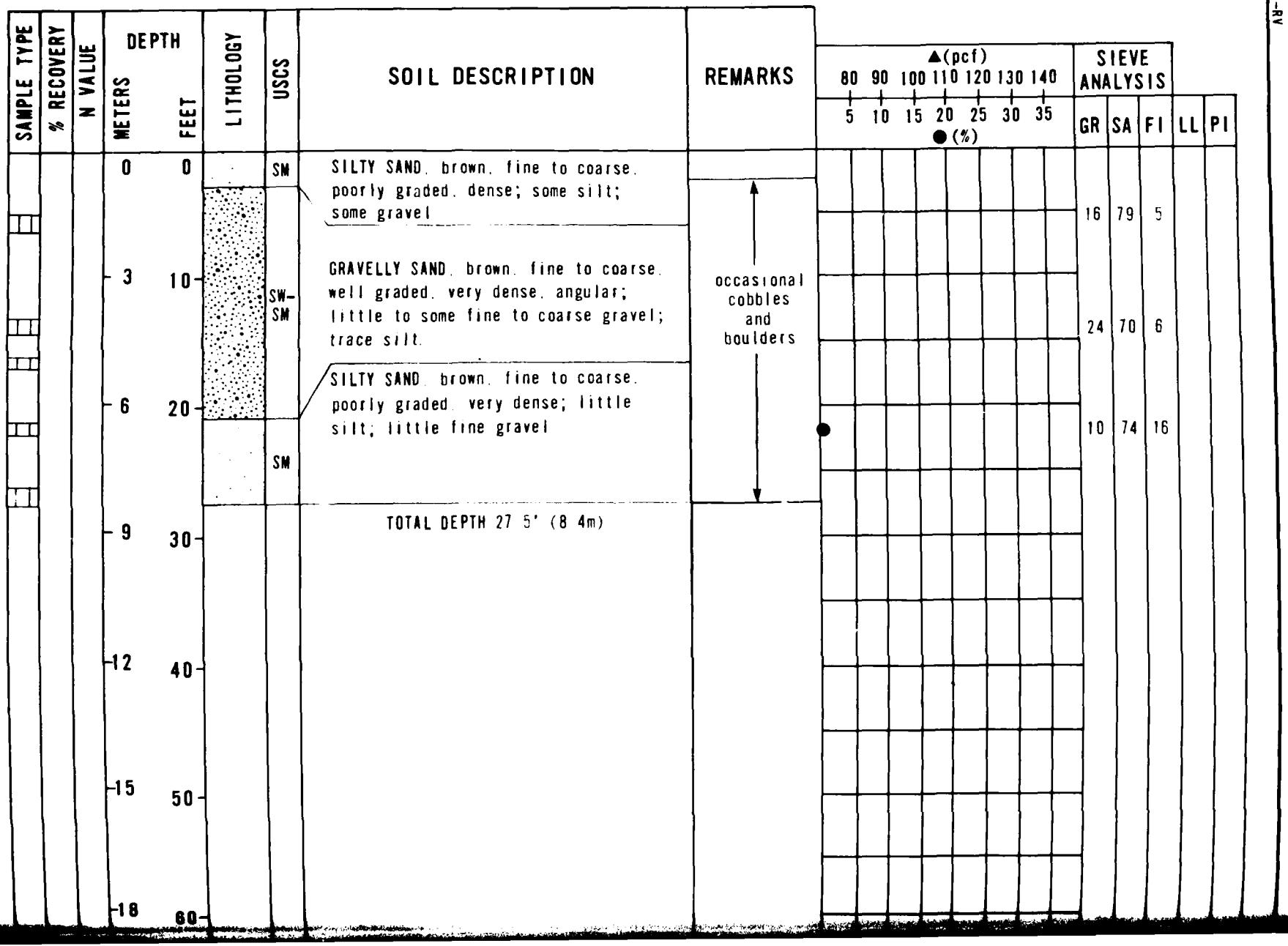

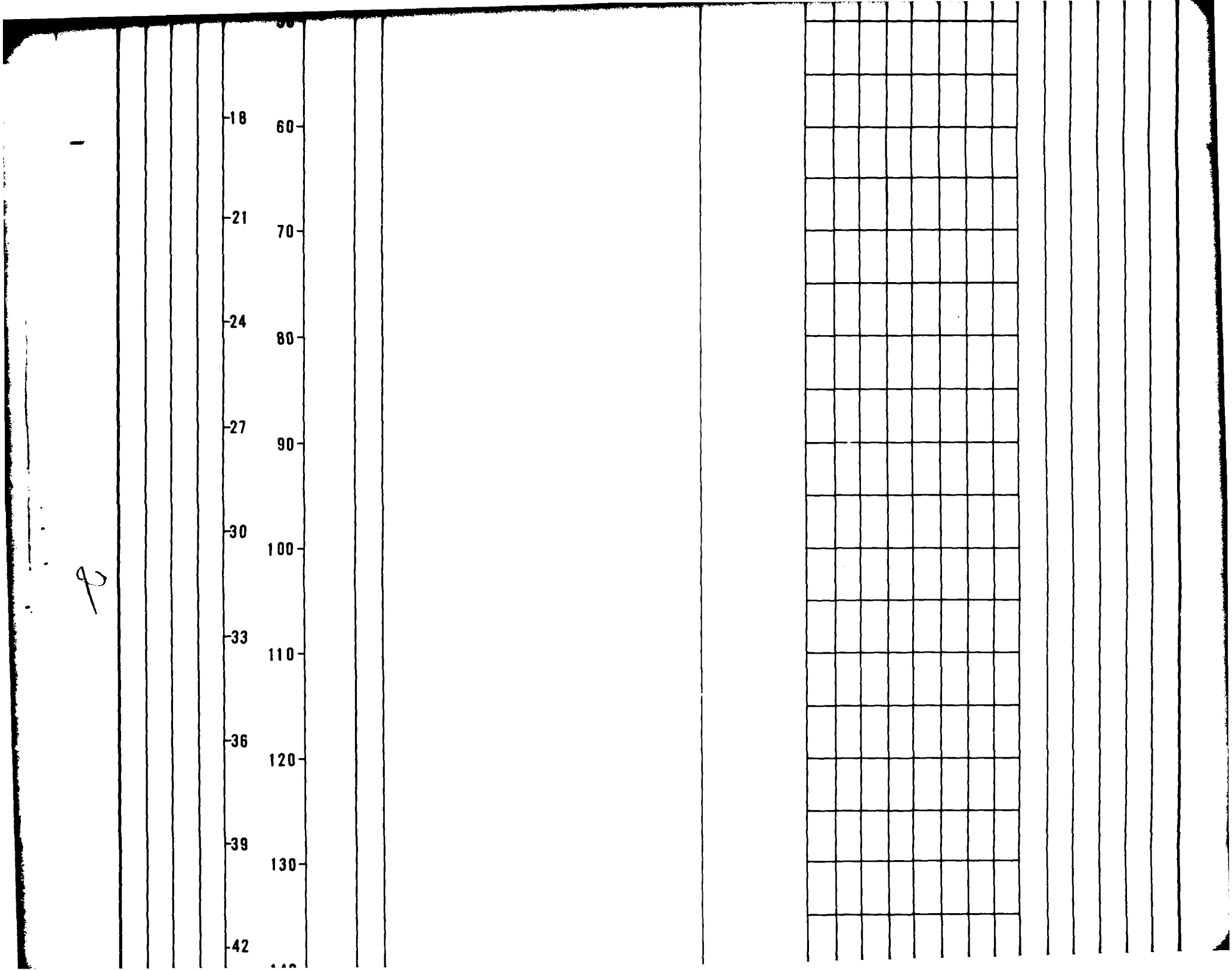
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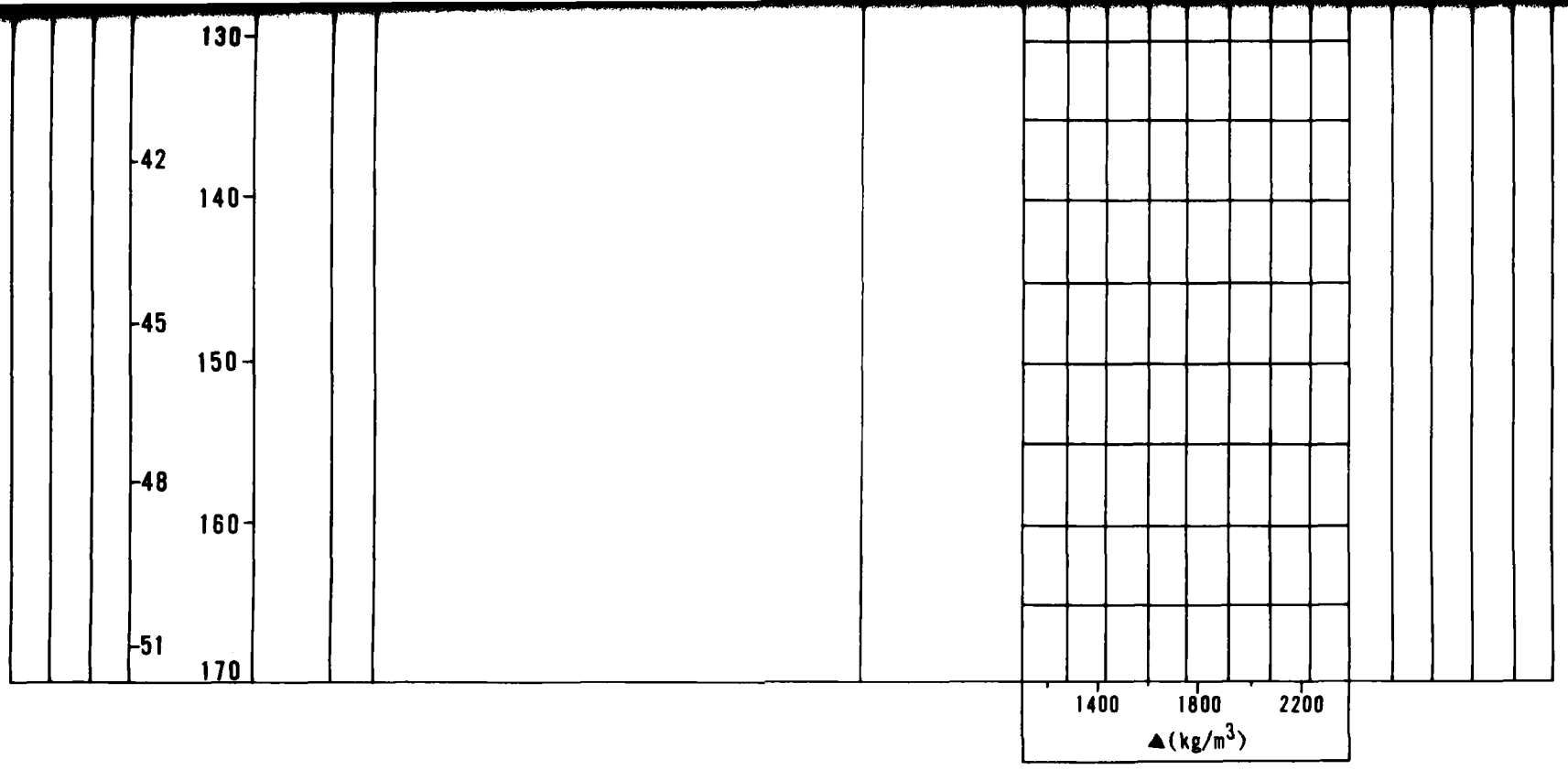

EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N – STANDARD PENETRATION RESISTANCE
- ▲ – DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● – MOISTURE CONTENT (ASTM: D-2216-71)
- NR – NO RECOVERY

BORING DETAILS

ELEVATION	:5760' (1756m)
SURFICIAL GEOLOGIC UNIT	:A5i
DATE DRILLED	:3 August 1977
DRILLING METHOD	:Becker Percussion
HOLE DIAMETER	:5 1/2" (140mm)
WATER LEVEL	:Not Encountered

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LOG OF BORING RV-B-2
RALSTON VALLEY, NEVADA

FIGURE II-4-2

AFV-06

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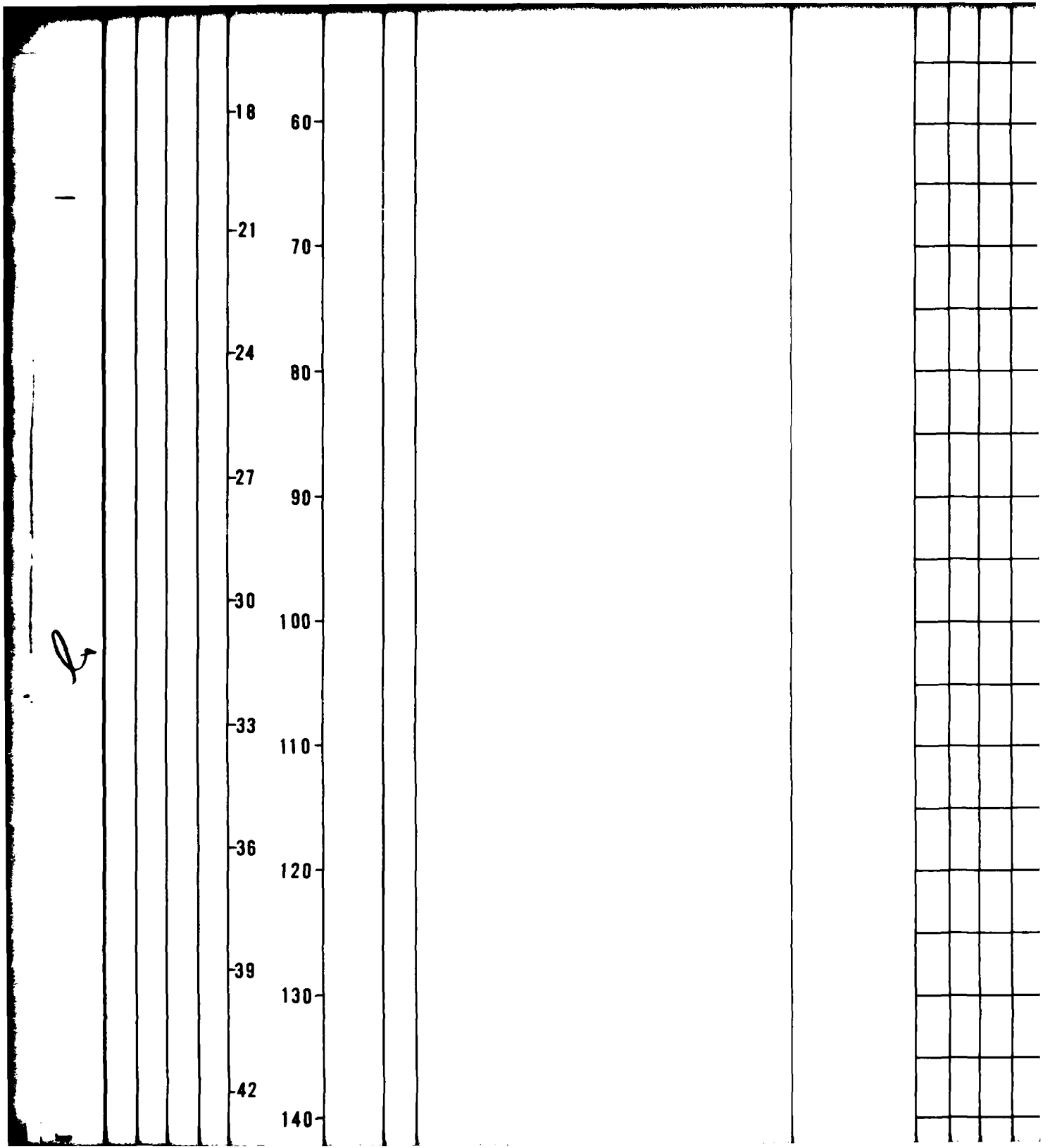
SAMPLE TYPE	% RECOVERY	N VALUE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	SOIL DESCRIPTION	REMARKS	▲(pcf) 80 90 100 110 120 130 140 / ● (%) 5 10 15 20 25 30 35	SIEVE ANALYSIS GR	SA	FI	LL	PI
			0	0			SILTY SAND, brown, fine to medium, poorly graded, medium dense to very dense, angular; little nonplastic silt.							
	73	26							●	4	83	13		
			3	10				began rotary drilling at 20.0'						
	60	56				SM			●					
			6	20				cobbles and boulders						
			9	30			TOTAL DEPTH 30.0' (9.1m)							
			12	40										
			15	50										
			18	60										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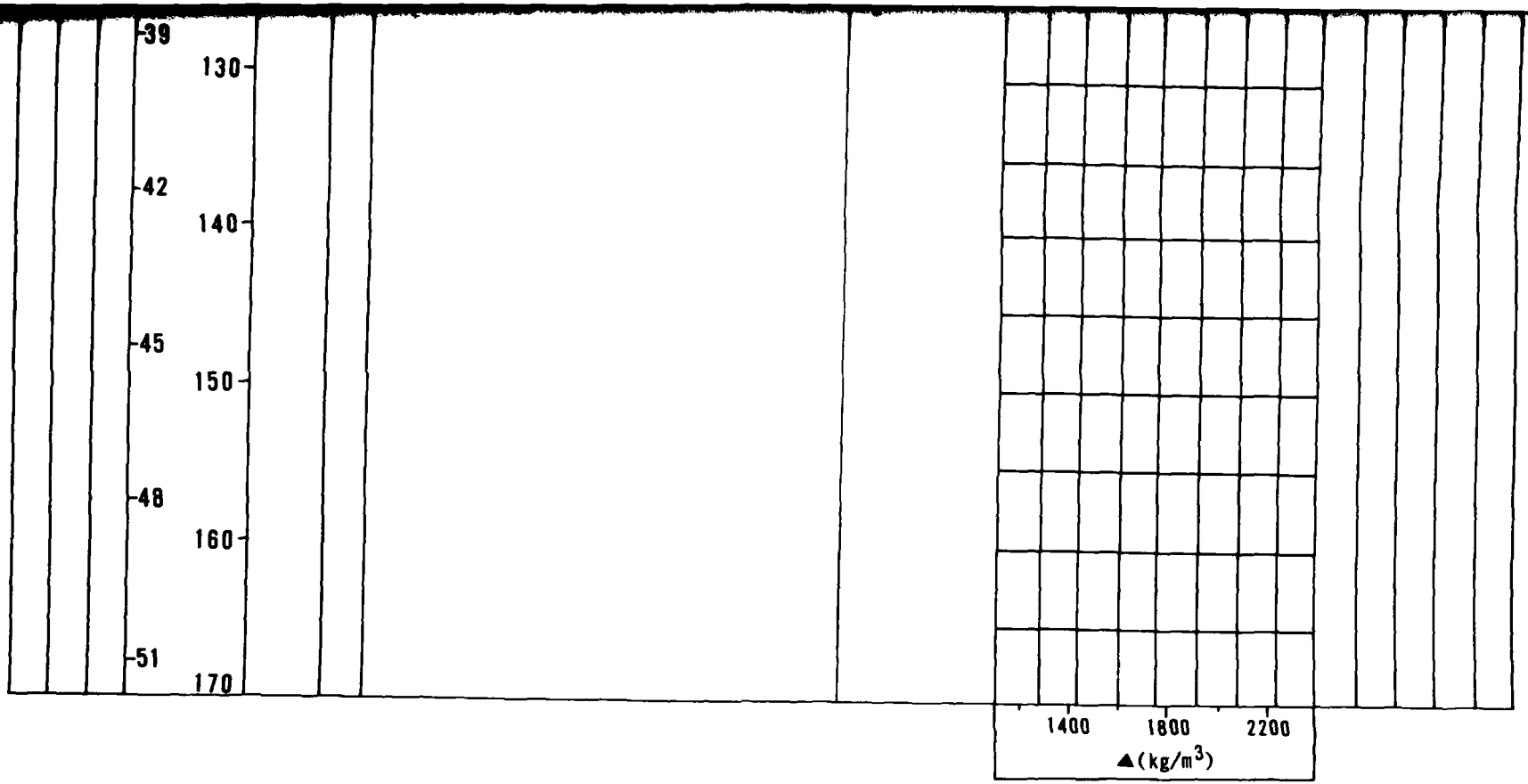

EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N – STANDARD PENETRATION RESISTANCE
- ▲ – DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● – MOISTURE CONTENT (ASTM: D-2216-71)
- NR – NO RECOVERY

BORING DETAILS

ELEVATION	:5535' (1687m)
SURFICIAL GEOLOGIC UNIT	:A5y
DATE DRILLED	:7 August 1977
DRILLING METHOD	:Becker Percussion
HOLE DIAMETER	:5 1/2" (140mm)
WATER LEVEL	:Not Encountered

FUGRO NATIONAL, INC.

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE · BMO

FIGURE II-4-3

LOG OF BORING RV-B-3
RALSTON VALLEY, NEVADA

AFV-08

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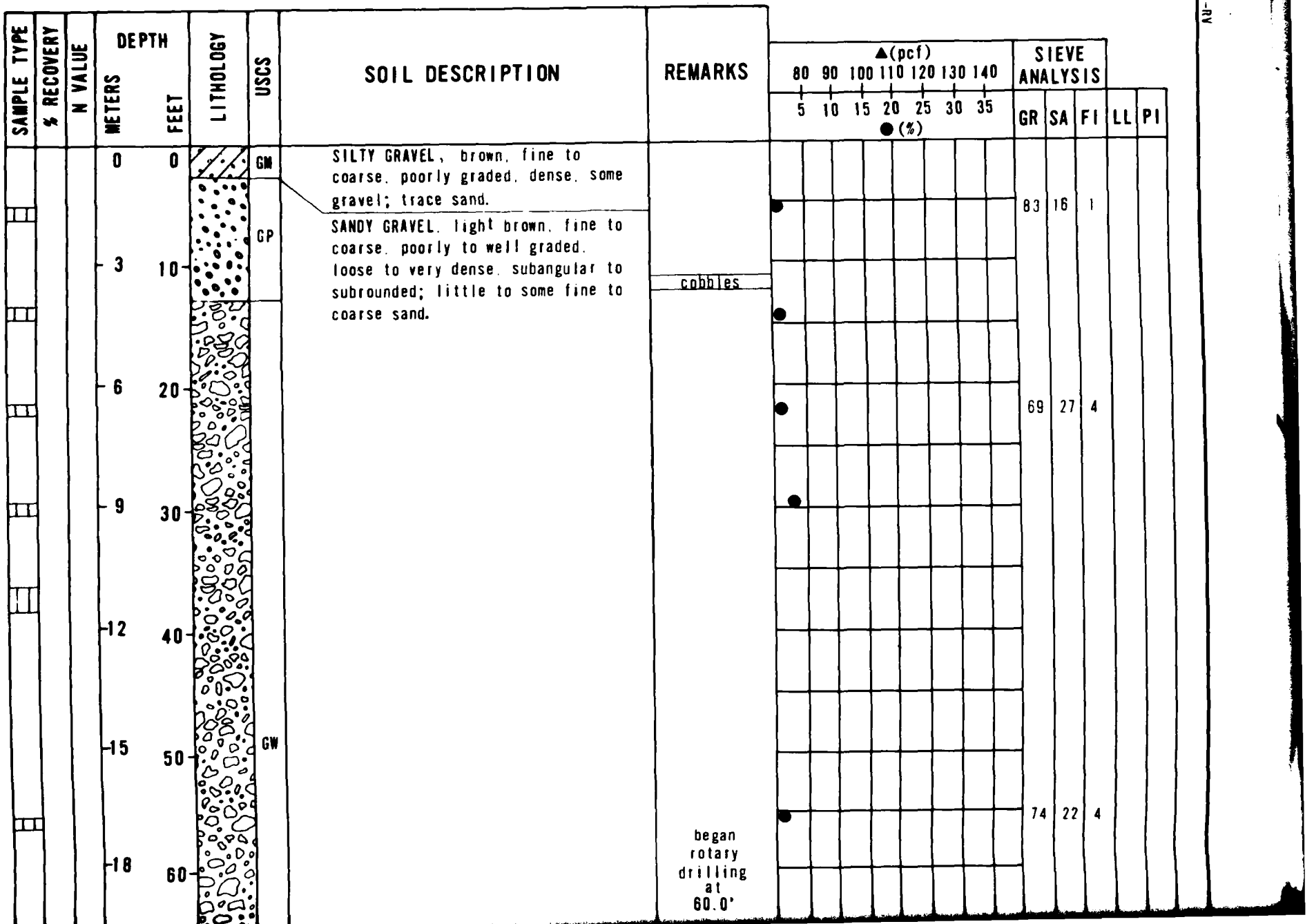
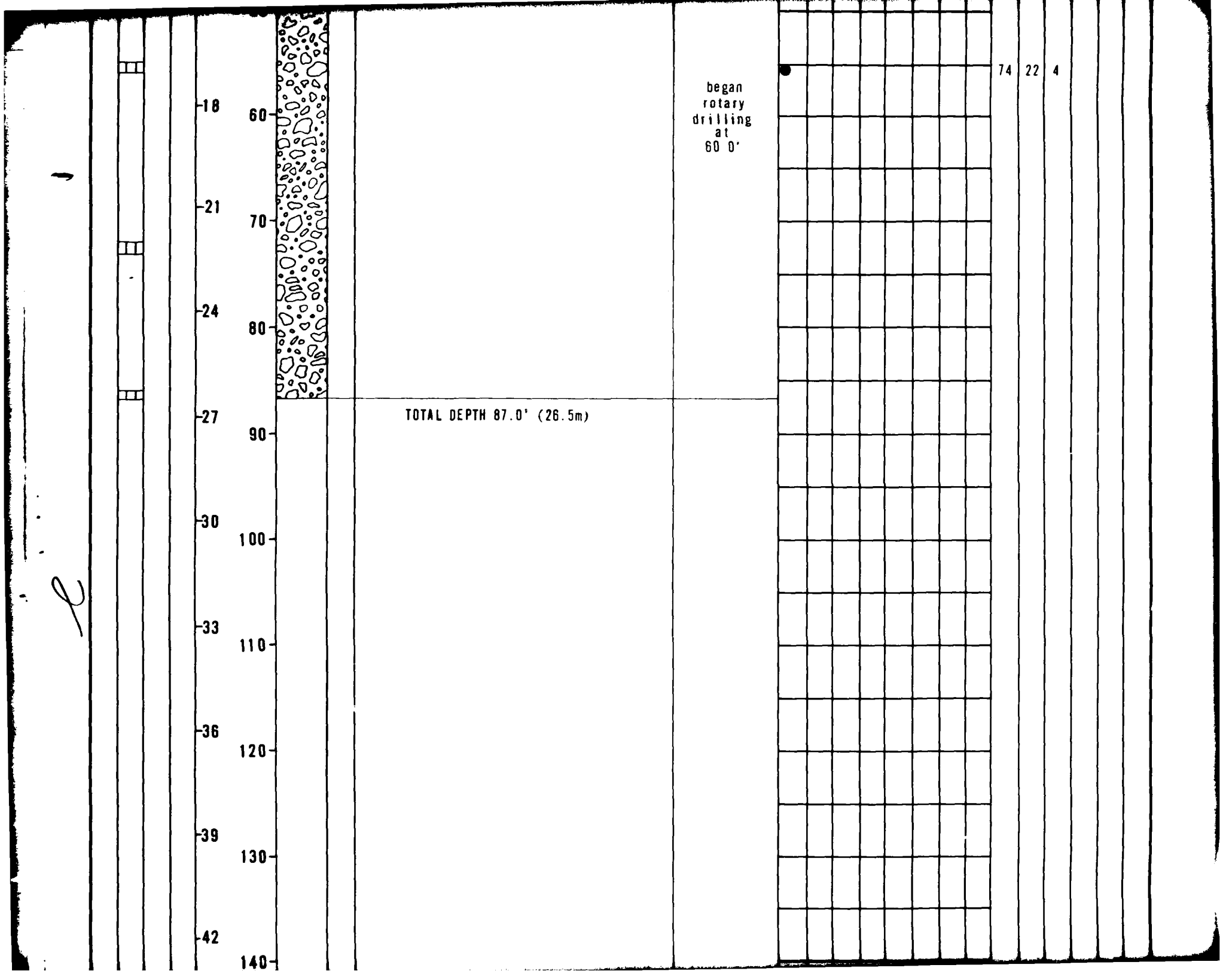
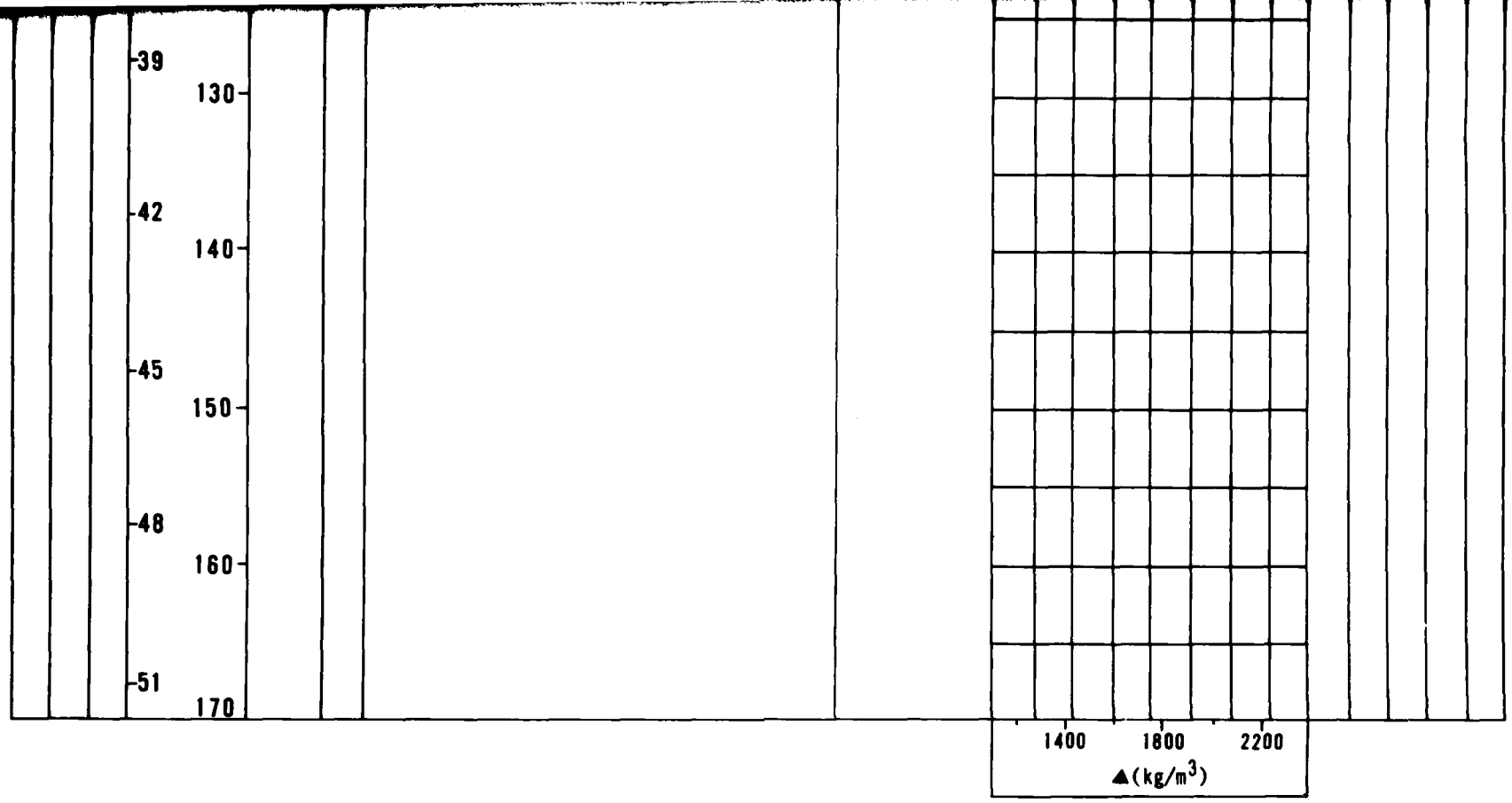
15 JUN 80

FN-1R-27-RV




18
21
24
27
30
33
36
39
42
60
70
80
90
100
110
120
130
140
began rotary drilling at 60.0'
TOTAL DEPTH 87.0' (26.5m)
74
22
4



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N - STANDARD PENETRATION RESISTANCE
- ▲ - DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● - MOISTURE CONTENT (ASTM: D-2216-71)
- NR - NO RECOVERY

BORING DETAILS

ELEVATION	:5480' (1670m)
SURFICIAL GEOLOGIC UNIT	:A5y
DATE DRILLED	:23-24 July 1977
DRILLING METHOD	:Becker Percussion
HOLE DIAMETER	:5 1 2" (140mm)
WATER LEVEL	:Not Encountered

FUGRO NATIONAL, INC.

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

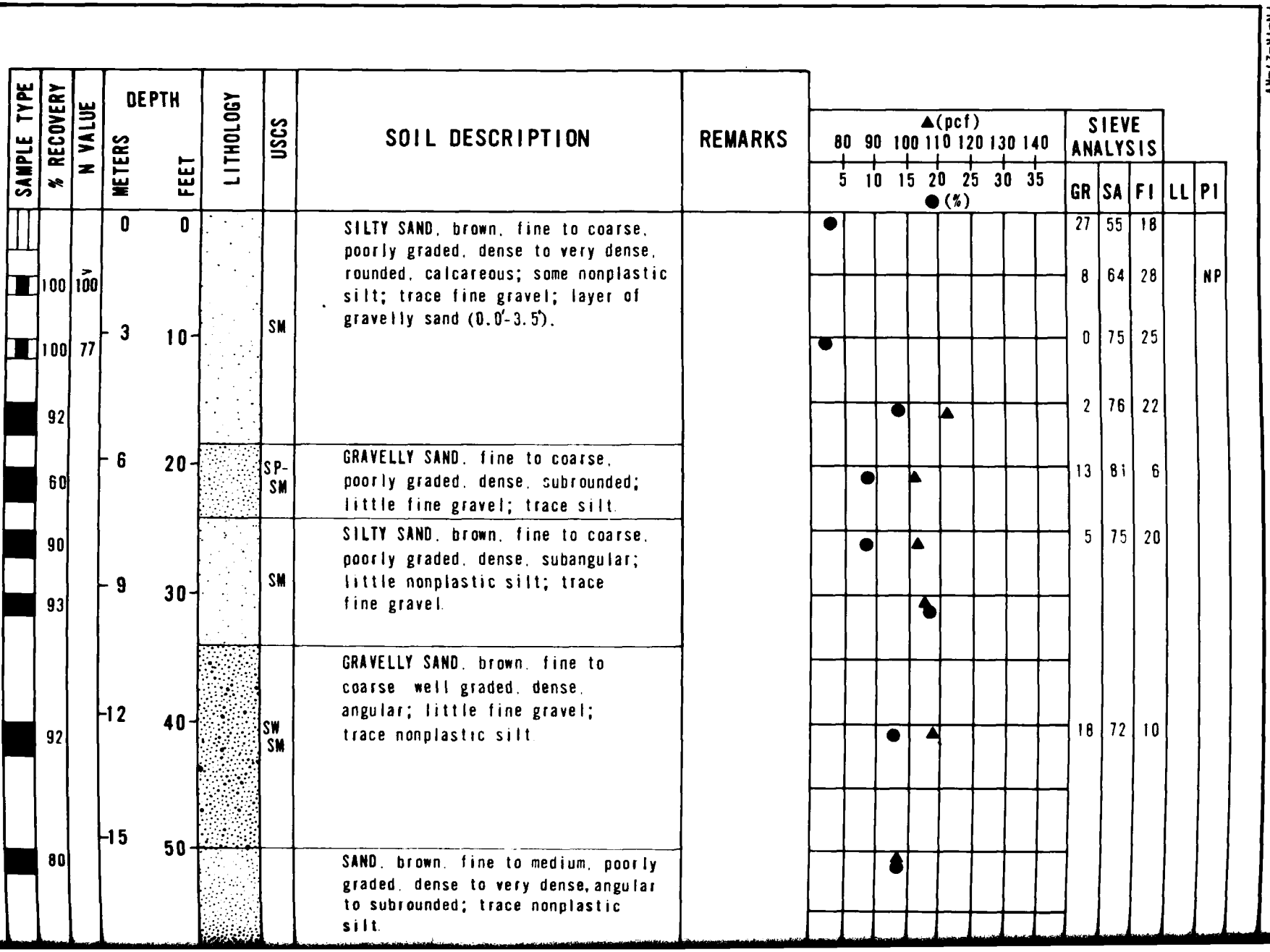
LOG OF BORING RV-B-4
RALSTON VALLEY, NEVADA

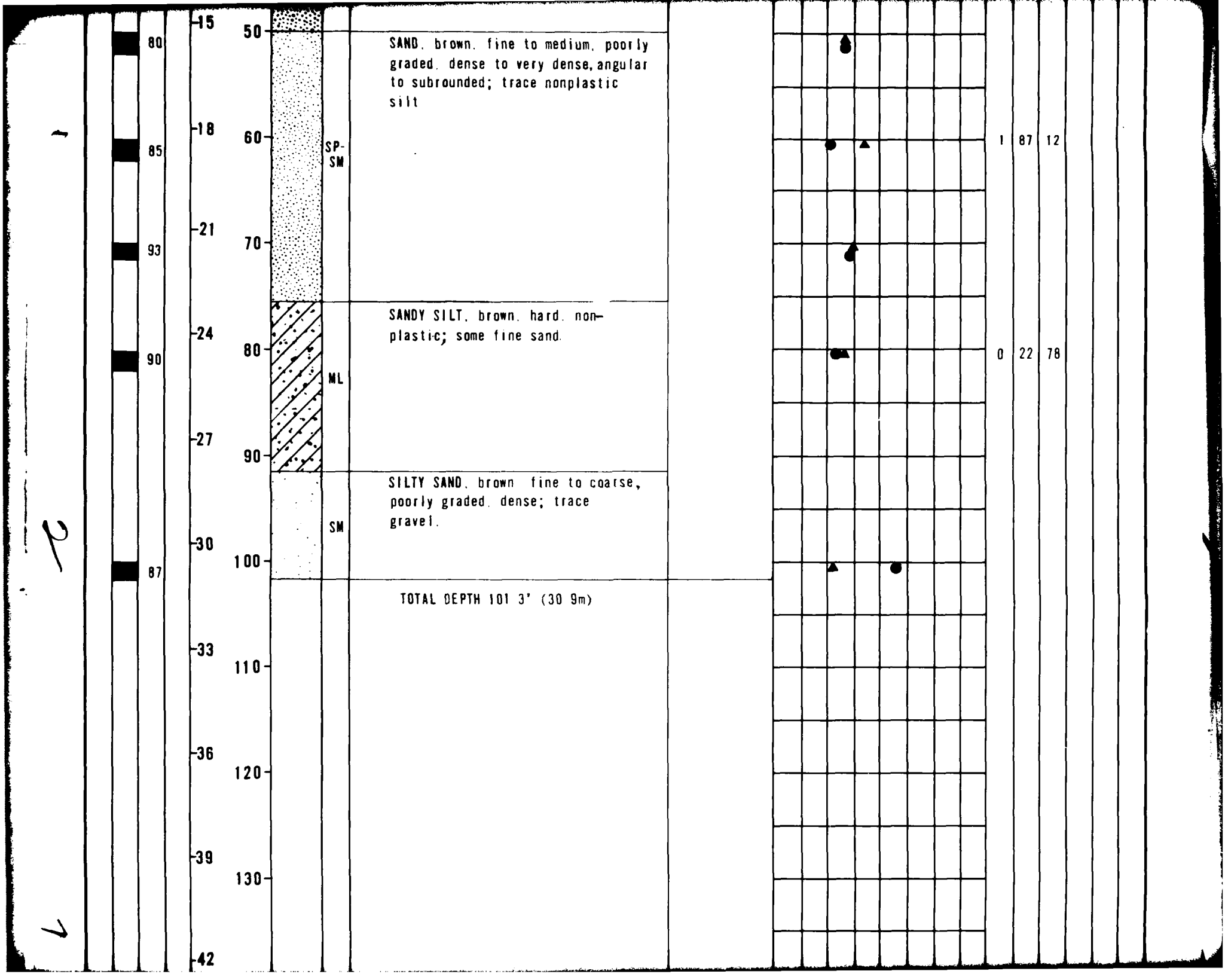
FIGURE II-4-4

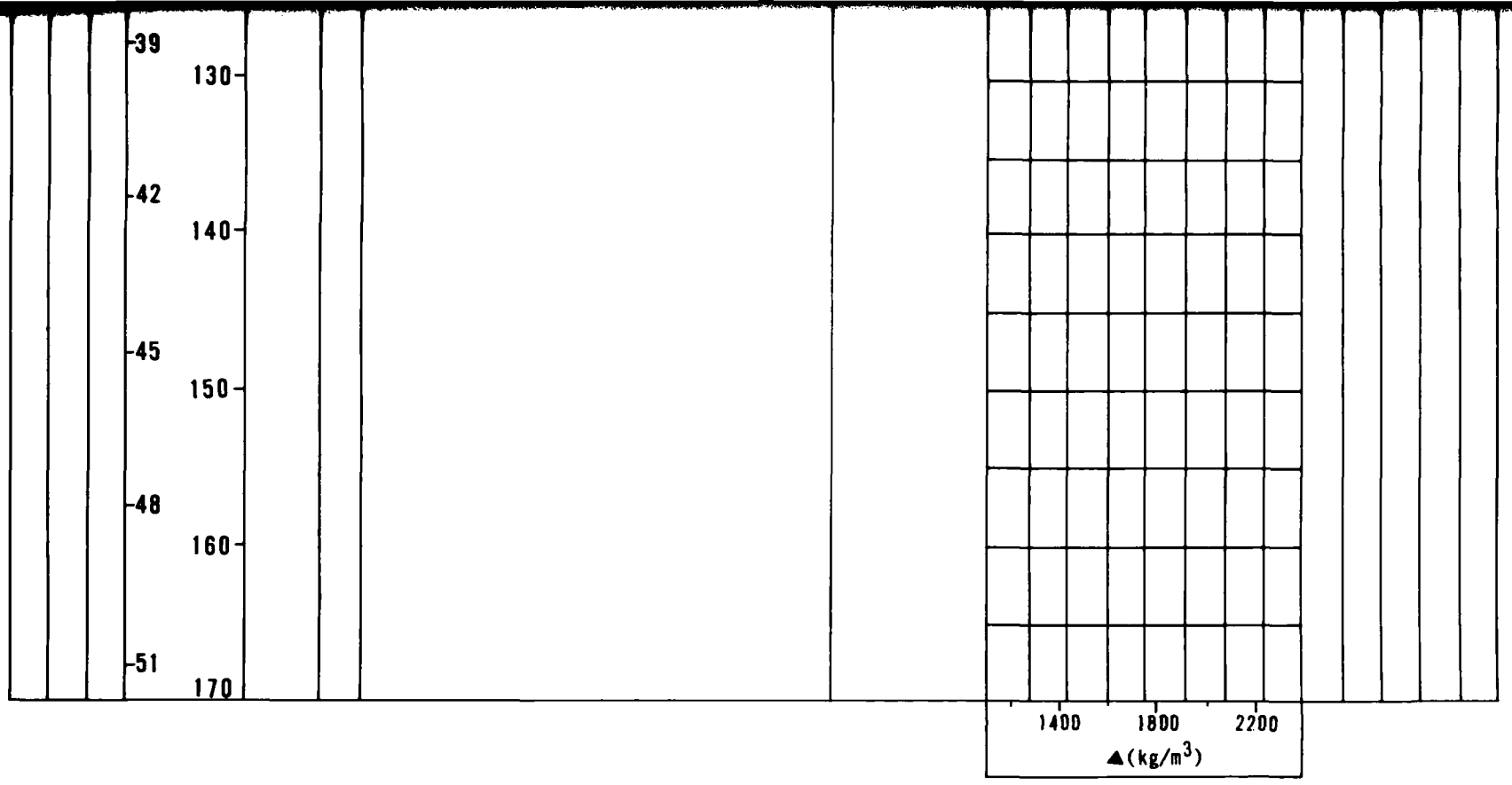
CHEC ... Y _____ APPR ... BY _____

15 JUN 80

FN-TR-27-RV




80
85
93
90
87
15
18
21
24
27
30
33
36
39
42
50
60
70
80
90
100
110
120
130
SP-SM
ML
SM
SAND, brown, fine to medium, poorly graded, dense to very dense, angular to subrounded; trace nonplastic silt
SANDY SILT, brown, hard, non-plastic; some fine sand.
SILTY SAND, brown fine to coarse, poorly graded, dense; trace gravel.
TOTAL DEPTH 101 3' (30 9m)
1 87 12
0 22 78



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N – STANDARD PENETRATION RESISTANCE
- ▲ – DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● – MOISTURE CONTENT (ASTM: D-2216-71)
- NR – NO RECOVERY

BORING DETAILS

ELEVATION	:5220' (1591m)
SURFICIAL GEOLOGIC UNIT	:A5y A4
DATE DRILLED	:15 August 1977
DRILLING METHOD	:Rotary Wash
HOLE DIAMETER	:4 7/8" (124mm)
WATER LEVEL	:Not Encountered

LOG OF BORING RV-B-5
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMO

FIGURE II-4-5

FUGRO NATIONAL, INC.

AFY-80

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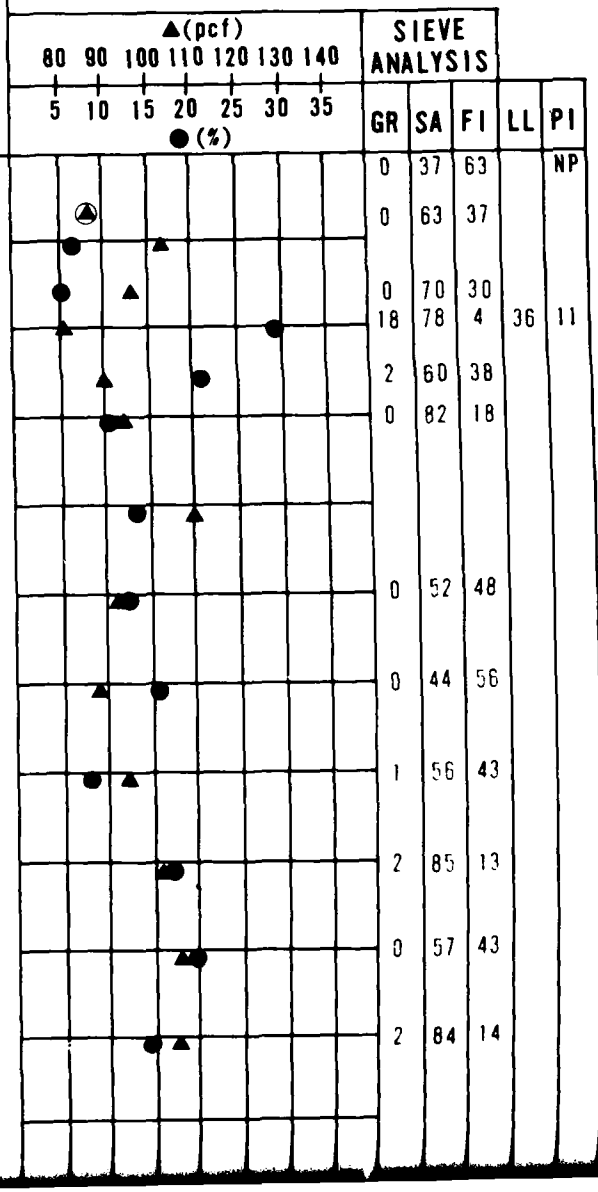
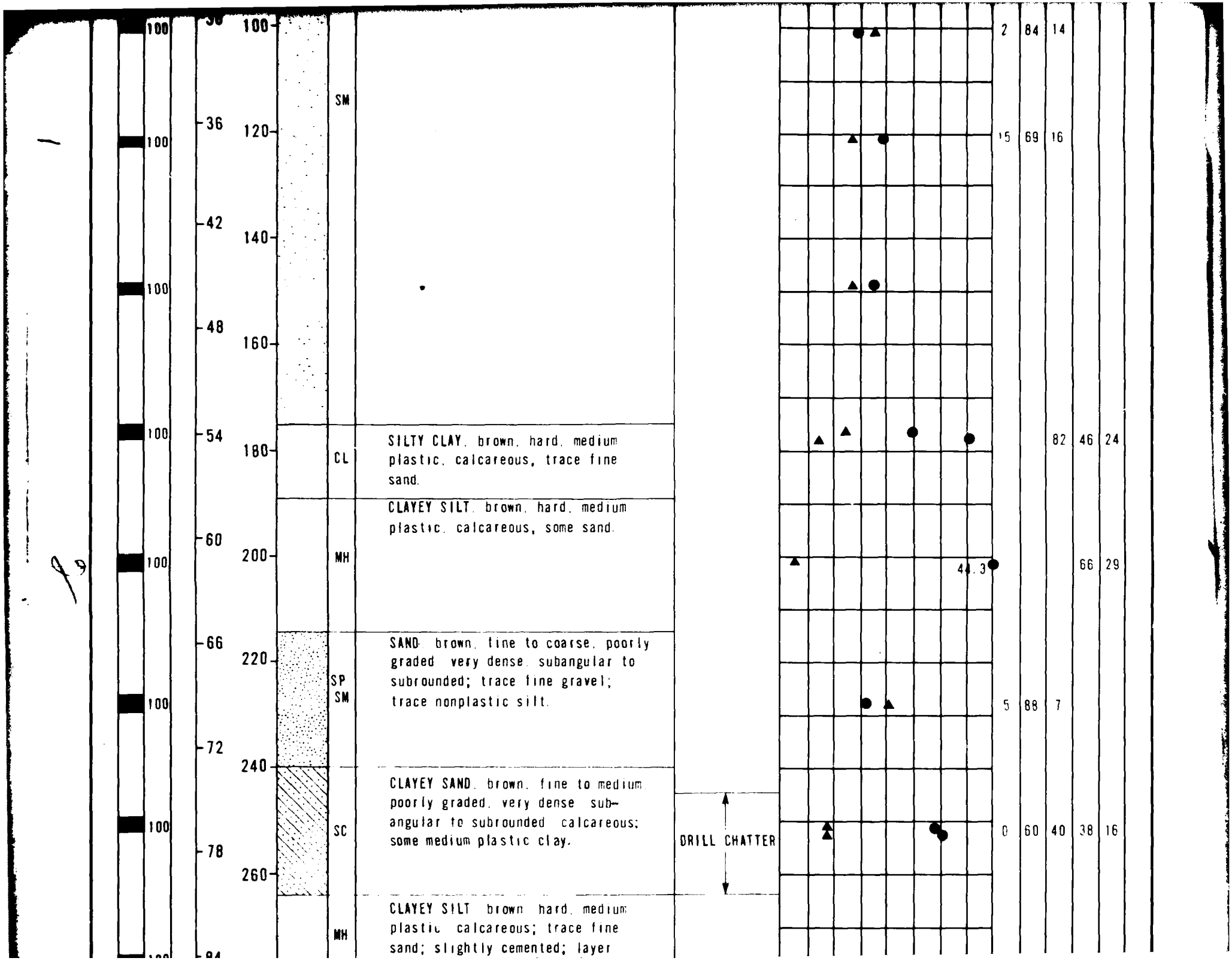
15 JUN 80

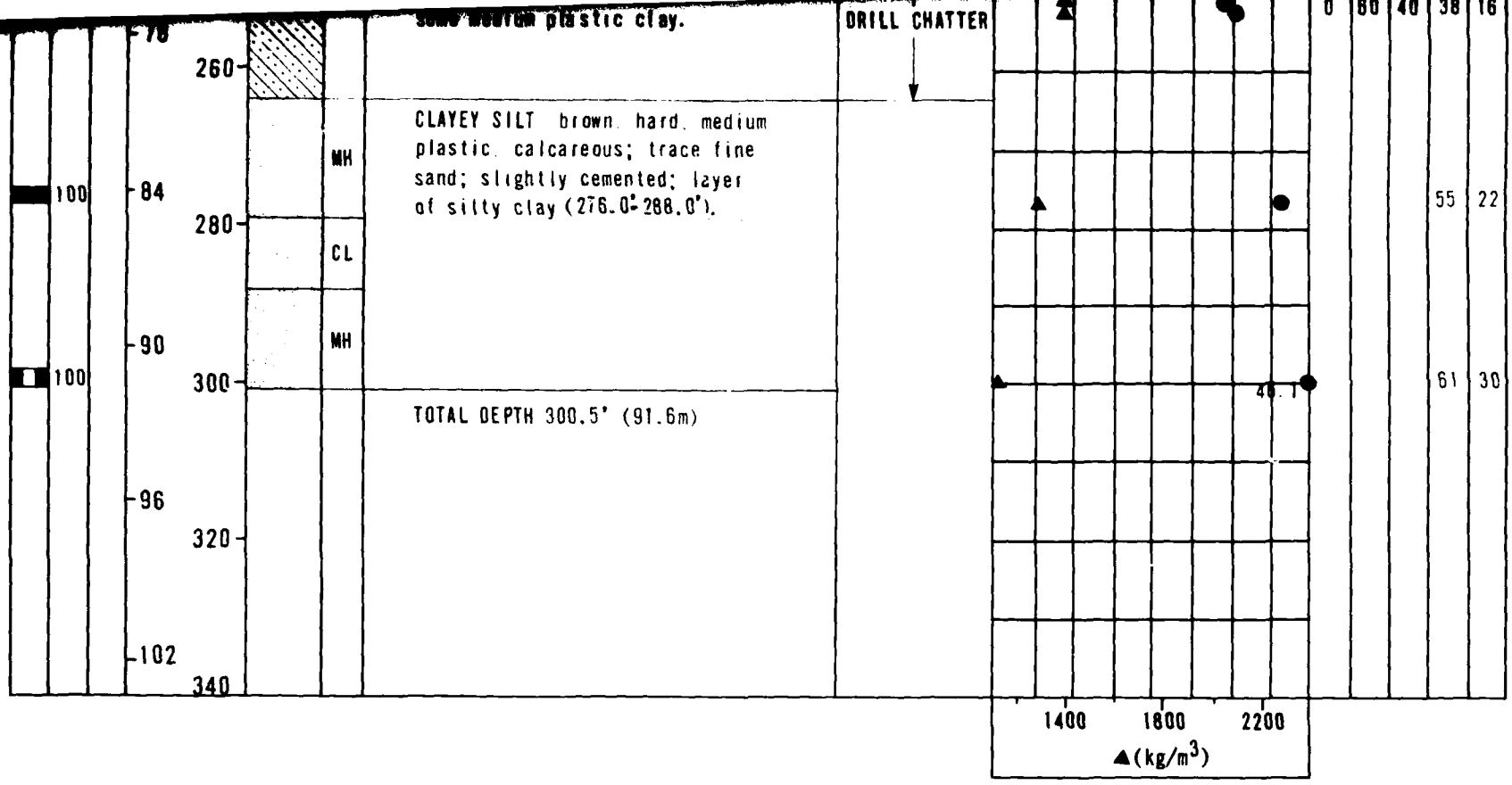
FN-TR-27-RV

SAMPLE TYPE	% RECOVERY	N VALUE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	SOIL DESCRIPTION	REMARKS
			0	0		ML	SILTY SAND, light gray, fine to medium, poorly graded, dense to very dense, angular to subangular calcareous; little to some nonplastic silt, trace to little fine gravel layers of sandy silt (0.0'-2.0') and (60.0'-62.0'); layer of gravelly sand (19.0'-22.0').	
	100					SM		
	100							
	100		6	20		SP		
	100							
	100							
	100		12	40		SM		
	100							
	100		18	60		ML		
	100							
	100		24	80				
	100							
	100		30	100				
						SM		



SIEVE ANALYSIS GR	SA	FI	LL	PI
0	37	63		NP
0	63	37		
0	70	30		
18	78	4	36	11
2	60	38		
0	82	18		
0	52	48		
0	44	56		
1	56	43		
2	85	13		
0	57	43		
2	84	14		


100
100
100
100
100
100
100
100
36
42
48
54
60
66
72
78
84
100
120
140
160
180
200
220
240
260
SM
CL
MH
SP
SM
SC
MH
SILTY CLAY. brown. hard. medium plastic. calcareous, trace fine sand.
CLAYEY SILT. brown. hard. medium plastic. calcareous, some sand.
SAND. brown. fine to coarse. poorly graded very dense subangular to subrounded; trace fine gravel; trace nonplastic silt.
CLAYEY SAND. brown. fine to medium poorly graded. very dense sub-angular to subrounded calcareous; some medium plastic clay.
CLAYEY SILT brown hard. medium plastic calcareous; trace fine sand; slightly cemented; layer
DRILL CHATTER
2 84 14
15 69 16
82 46 24
44.3
66 29
5 88 7
0 60 40 38 16



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N – STANDARD PENETRATION RESISTANCE
- ▲ – DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● – MOISTURE CONTENT (ASTM: D-2216-71)
- NR – NO RECOVERY

BORING DETAILS

ELEVATION	:5180'.(1579m)
SURFICIAL GEOLOGIC UNIT	:A4
DATE DRILLED	:19-20 August 1979
DRILLING METHOD	:Rotary Wash
HOLE DIAMETER	:4 7 8" (124mm)
WATER LEVEL	:Not Encountered

FUGRO NATIONAL, INC.

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

LOG OF BORING RV-B-6
RALSTON VALLEY, NEVADA

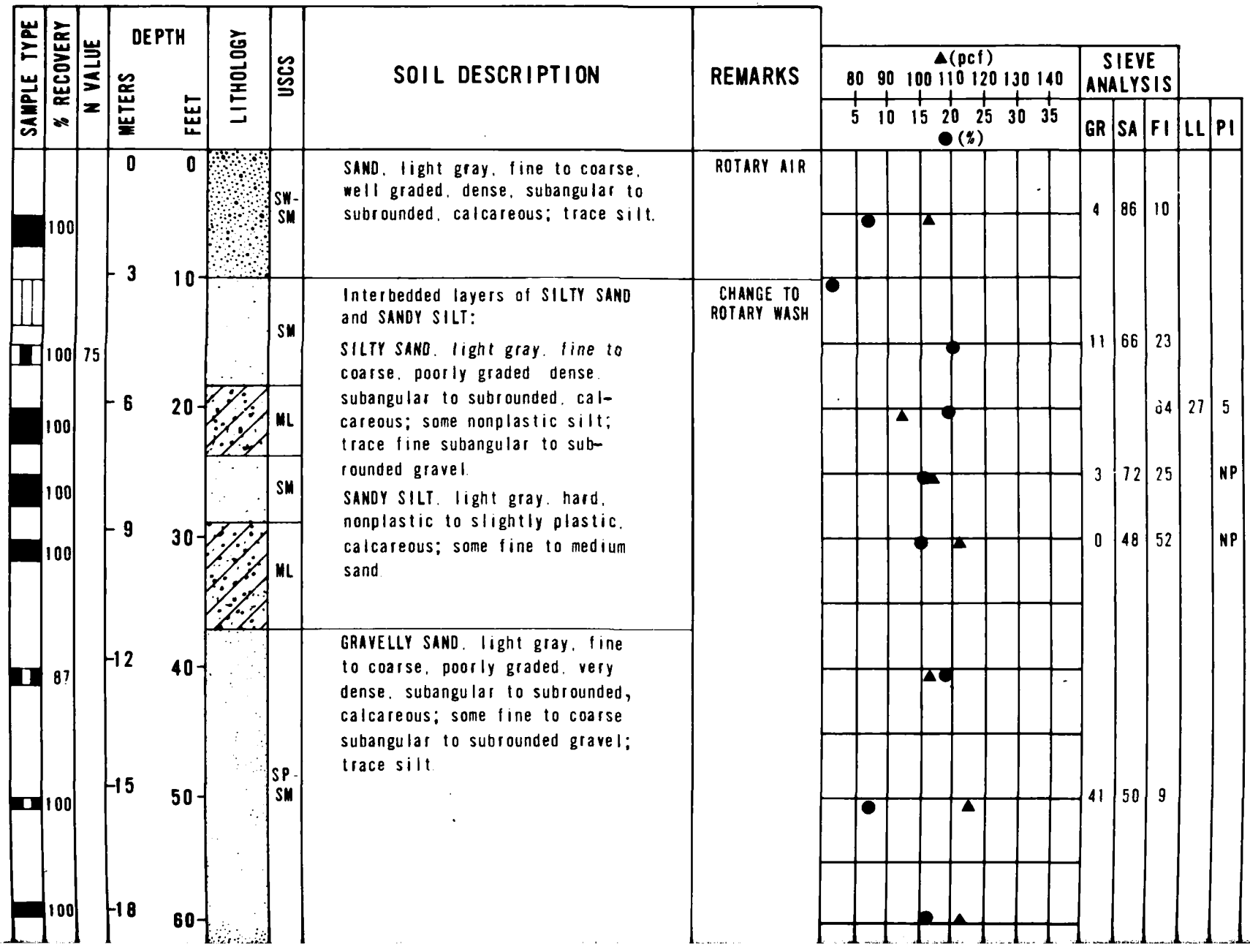
FIGURE II-4-6

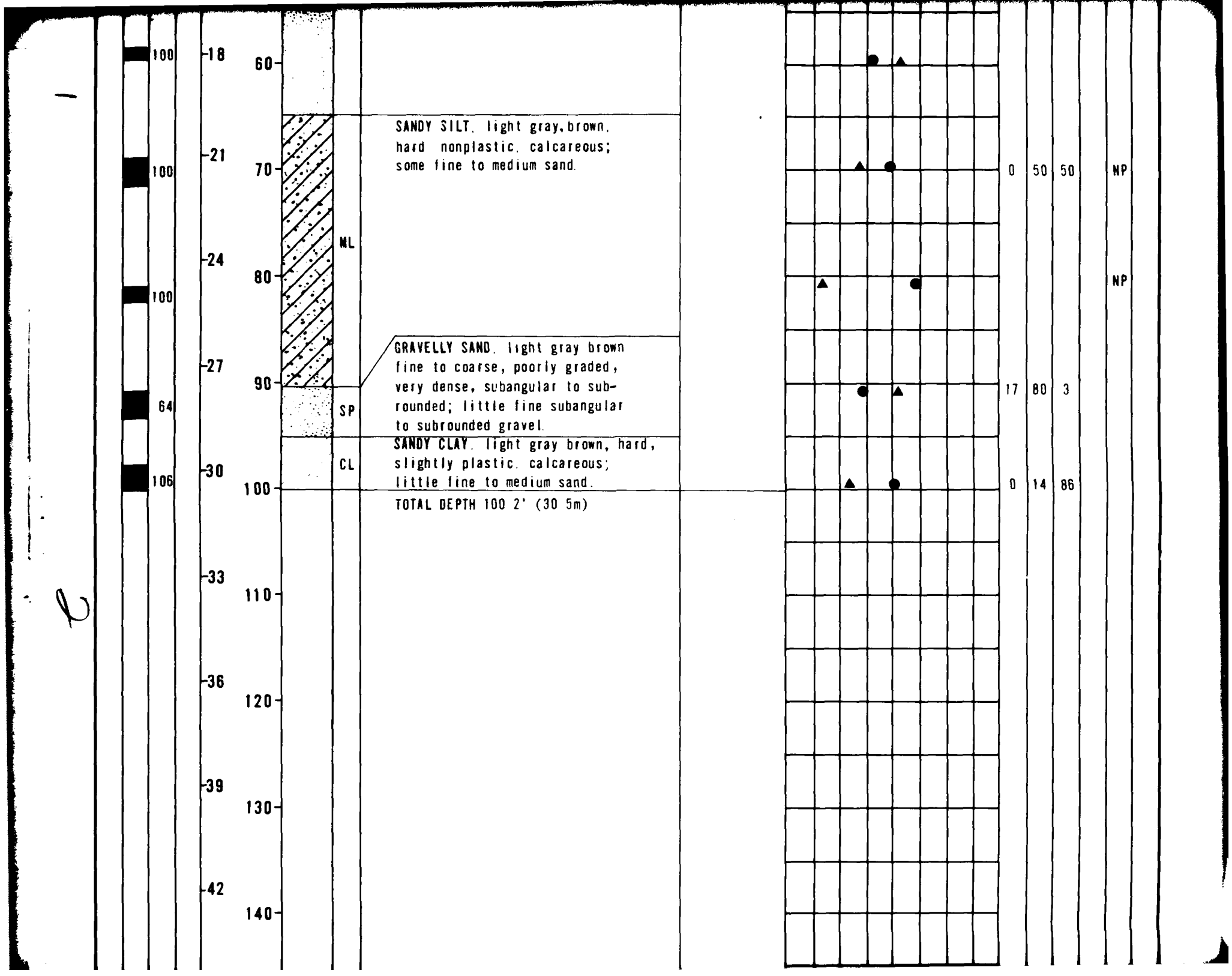
AFV-06

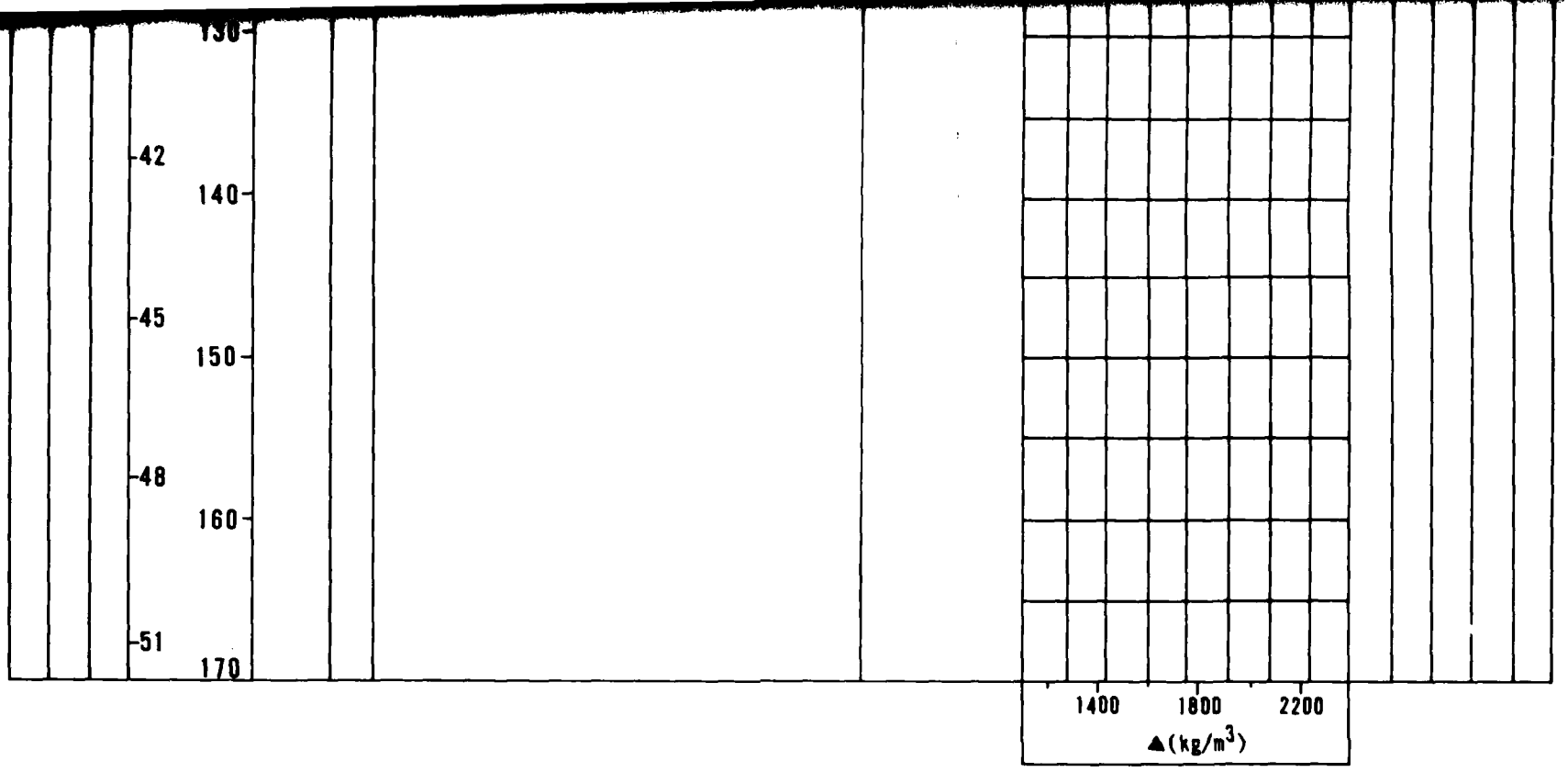
CHK'D BY _____ APP'D BY _____

15 JUN 80

FN-TR-27-RV




100
100
100
64
106
18
21
24
27
30
33
36
39
42
60
70
80
90
100
110
120
130
140
ML
SP
CL
SANDY SILT. light gray, brown, hard nonplastic. calcareous; some fine to medium sand.
GRAVELLY SAND. light gray brown fine to coarse, poorly graded, very dense, subangular to sub-rounded; little fine subangular to subrounded gravel.
SANDY CLAY. light gray brown, hard, slightly plastic. calcareous; little fine to medium sand.
TOTAL DEPTH 100 2' (30 5m)
0 50 50 NP
NP
17 80 3
0 14 86



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N – STANDARD PENETRATION RESISTANCE
- ▲ – DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● – MOISTURE CONTENT (ASTM: D-2216-71)
- NR – NO RECOVERY

BORING DETAILS

ELEVATION	: 5240′ (1597m)
SURFICIAL GEOLOGIC UNIT	: A5y A4
DATE DRILLED	: 17-18 August 1977
DRILLING METHOD	: Rotary Air Wash
HOLE DIAMETER	: 4 7 8" (124mm)
WATER LEVEL	: Not Encountered

LOG OF BORING RV-B-7
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-4-7

FUGRO NATIONAL, INC.

AFV-06

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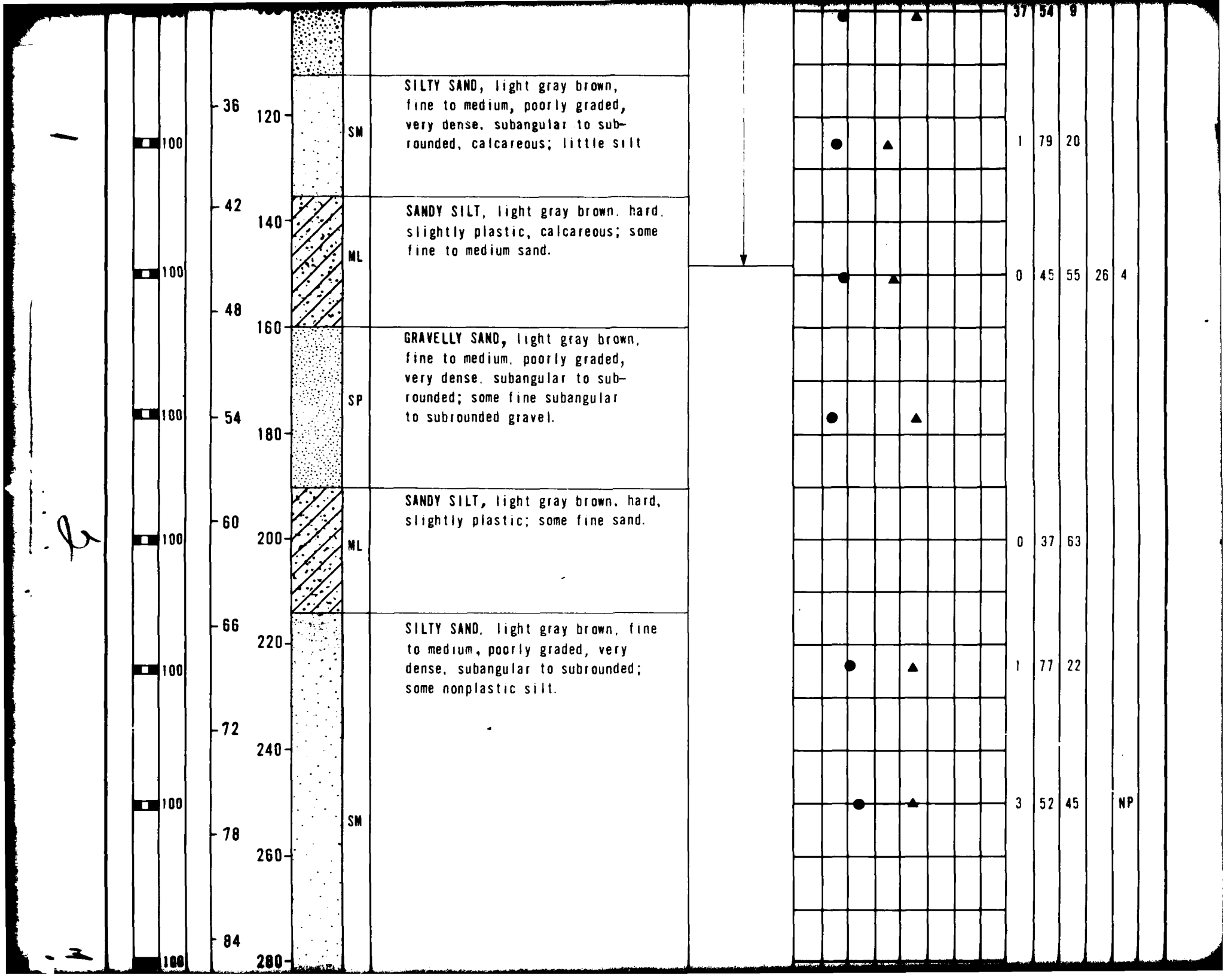
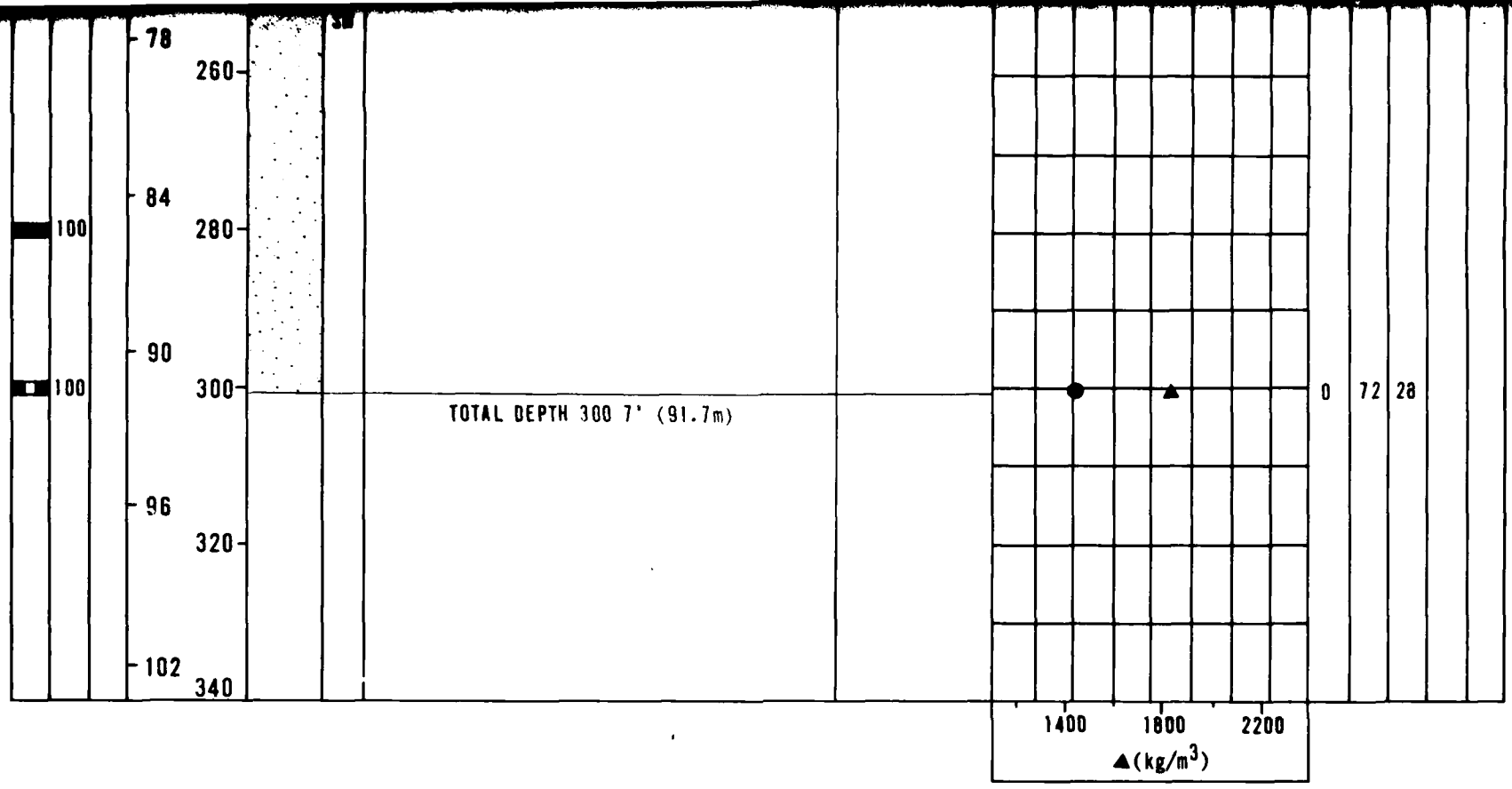
SAMPLE TYPE	% RECOVERY	N VALUE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	SOIL DESCRIPTION	REMARKS	▲(pcf) 80 90 100 110 120 130 140 / ●(%) 5 10 15 20 25 30 35	SIEVE ANALYSIS GR	SA	FI	LL	PI
	100		0	0		SP SM	GRAVELLY SAND, light brown gray, fine to coarse, poorly to well graded very dense, subangular to subrounded, calcareous; some fine to coarse subrounded to subangular gravel; trace silt; little slightly plastic clay; layer of clayey sand (20.0'-24.0').	gravel to 2"	● ▲	33	59	8		
	100								● ▲					
	100					SW SM			● ▲	31	57	12		
	100		6	20					● ▲	11	71	18		
	100							gravel to 3"	● ▲	11	74	15	35	20
	100					SC			● ▲	23	62	15	34	13
	100		12	40					● ▲	23	59	18		
	100					GW GM	SANDY GRAVEL light gray brown, fine to coarse, well graded, very dense, subangular to subrounded; some fine to coarse sand; trace silt.	drill chatter	● ▲	47	46	7		
	100		18	60					● ▲					
	100						GRAVELLY SAND light gray brown, fine to coarse, well graded very dense, subangular to subrounded, calcareous; some fine to coarse subangular to subrounded gravel; trace nonplastic silt.		● ▲	46	47	7		
	100		24	80		SW SM			● ▲					
	100								● ▲					
	100		30	100					● ▲	37	54	9		
									● ▲					
			36	120		SM	SILTY SAND, light gray brown, fine to medium, poorly graded, very dense, subangular to subrounded, calcareous; little silt.		● ▲	1	79	20		


100
100
100
100
100
100
100
36
42
48
54
60
66
72
78
84
120
140
160
180
200
220
240
260
280
SM
ML
SP
ML
SM
SILTY SAND, light gray brown, fine to medium, poorly graded, very dense, subangular to subrounded, calcareous; little silt
SANDY SILT, light gray brown, hard, slightly plastic, calcareous; some fine to medium sand.
GRAVELLY SAND, light gray brown, fine to medium, poorly graded, very dense, subangular to subrounded; some fine subangular to subrounded gravel.
SANDY SILT, light gray brown, hard, slightly plastic; some fine sand.
SILTY SAND, light gray brown, fine to medium, poorly graded, very dense, subangular to subrounded; some nonplastic silt.
37 54 9
1 79 20
0 45 55 26 4
0 37 63
1 77 22
3 52 45 NP



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N - STANDARD PENETRATION RESISTANCE
- ▲ - DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● - MOISTURE CONTENT (ASTM: D-2216-71)
- NR - NO RECOVERY

BORING DETAILS

ELEVATION	:5335' (1626m)
SURFICIAL GEOLOGIC UNIT	:A5y
DATE DRILLED	:15-16 August 1977
DRILLING METHOD	:Rotary Wash
HOLE DIAMETER	:4 7/8" (124mm)
WATER LEVEL	:Not Encountered

FUGRO NATIONAL, INC.

LOG OF BORING RV-B-8
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-4-8

AFV-06

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15 JUN 80

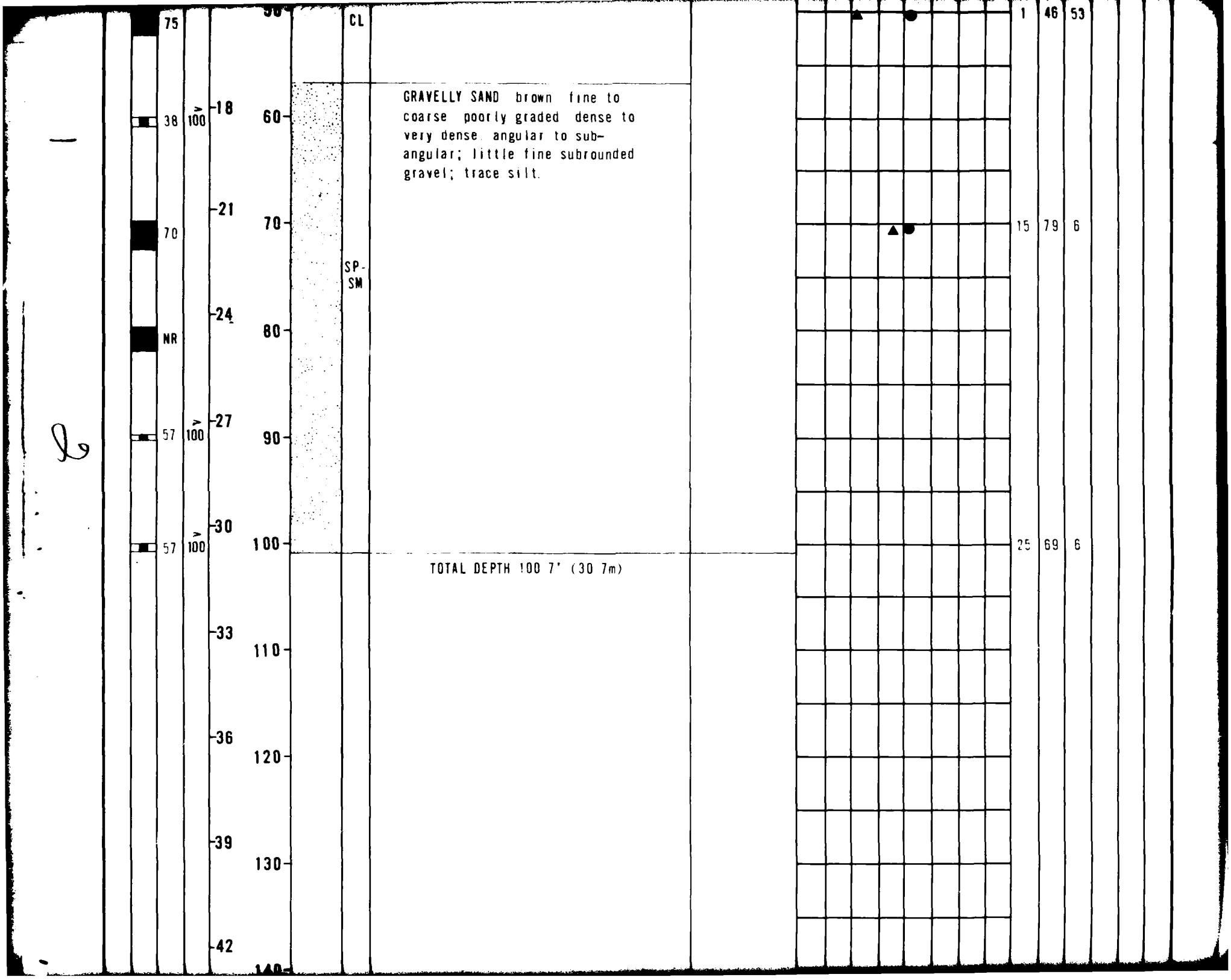
FN-TR-27-RV

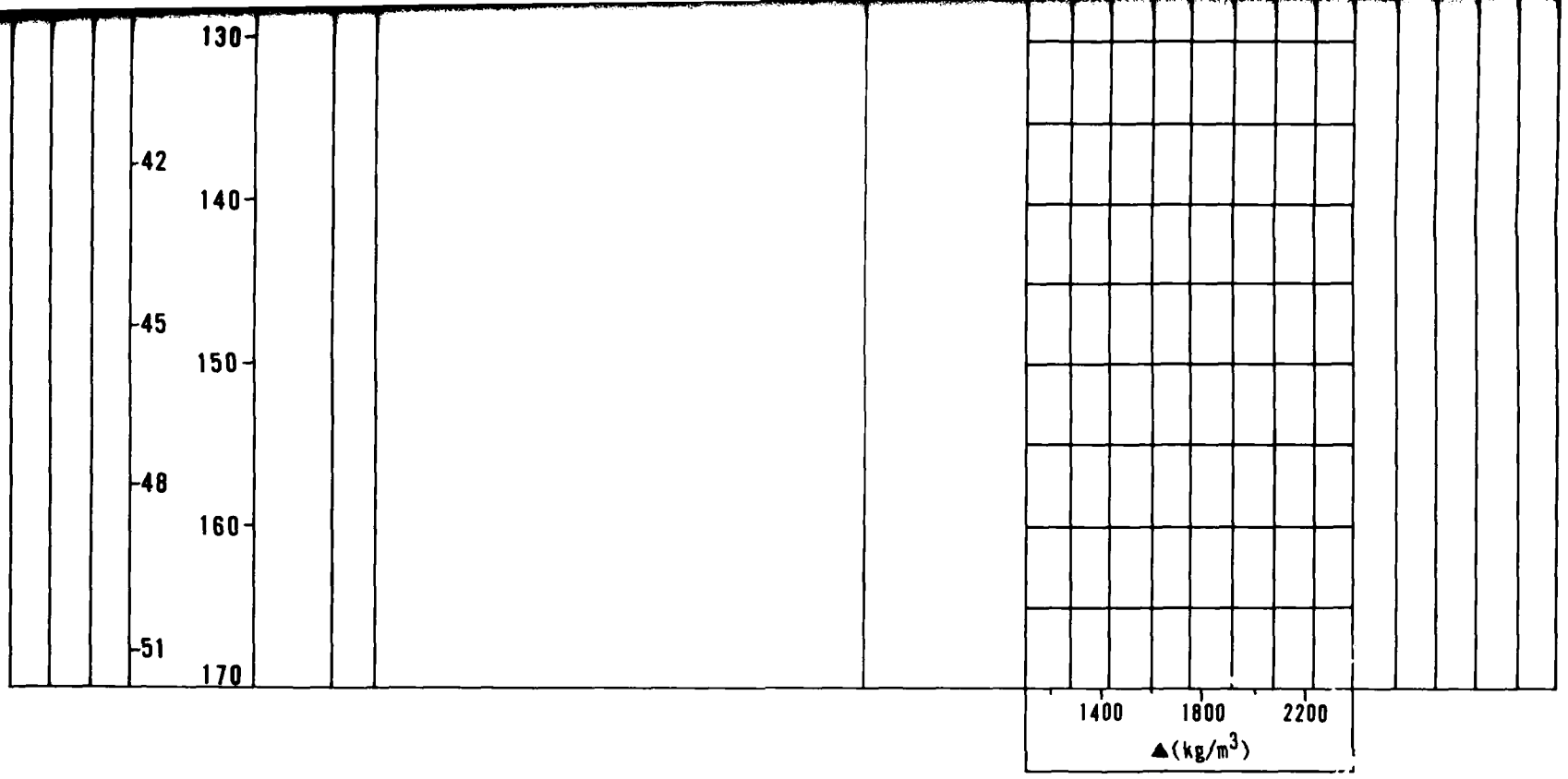
SAMPLE TYPE	% RECOVERY	N VALUE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	SOIL DESCRIPTION	REMARKS
	67	31	0	0		SM	SILTY SAND, brown, fine to coarse, poorly graded, dense to very dense, subangular, calcareous; some silt; little fine subangular gravel.	
	40	100/v	3	10				
	63					SP-SC	SAND, light brown to brown, fine to coarse, poorly graded, very dense; trace slightly plastic clay.	
	67	100/v	6	20		CL	SANDY CLAY, brown, hard, slightly plastic, little fine sand.	
	43	100/v					SAND brown fine to coarse poorly graded dense subangular; trace silt; trace fine gravel.	
	90		9	30		SP-SM		
	100	100/v	12	40				
			15				SANDY CLAY brown stiff slightly plastic, some fine to coarse sand.	
	75			50		CL		
	38	100/v	18	60			GRAVELLY SAND brown fine to coarse, poorly graded dense to very dense, angular to sub-	

▲(pcf) 80 90 100 110 120 130 140

● (%) 5 10 15 20 25 30 35

SIEVE ANALYSIS GR	SA	FI	LL	PI
15	62	23		
		7	25	9
0	13	87		
9	83	8		
1	46	53		


75
38
70
NR
57
57
>100
>100
>100
18
21
24
27
30
33
36
39
42
60
70
80
90
100
110
120
130
CL
SP-
SM
GRAVELLY SAND brown fine to coarse poorly graded dense to very dense angular to sub-angular; little fine subrounded gravel; trace silt.
TOTAL DEPTH 100 7' (30 7m)
1
46
53
15
79
6
25
69
6



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N – STANDARD PENETRATION RESISTANCE
- ▲ – DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● – MOISTURE CONTENT (ASTM: D-2216-71)
- NR – NO RECOVERY

BORING DETAILS

ELEVATION	:5285' (1611m)
SURFICIAL GEOLOGIC UNIT	:A5y A4
DATE DRILLED	:16 August 1977
DRILLING METHOD	:Rotary Wash
HOLE DIAMETER	:4 7 8" (124mm)
WATER LEVEL	:Not Encountered

FUGRO NATIONAL, INC.

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

LOG OF BORING RV-8-9
RALSTON VALLEY, NEVADA

FIGURE II-4-9

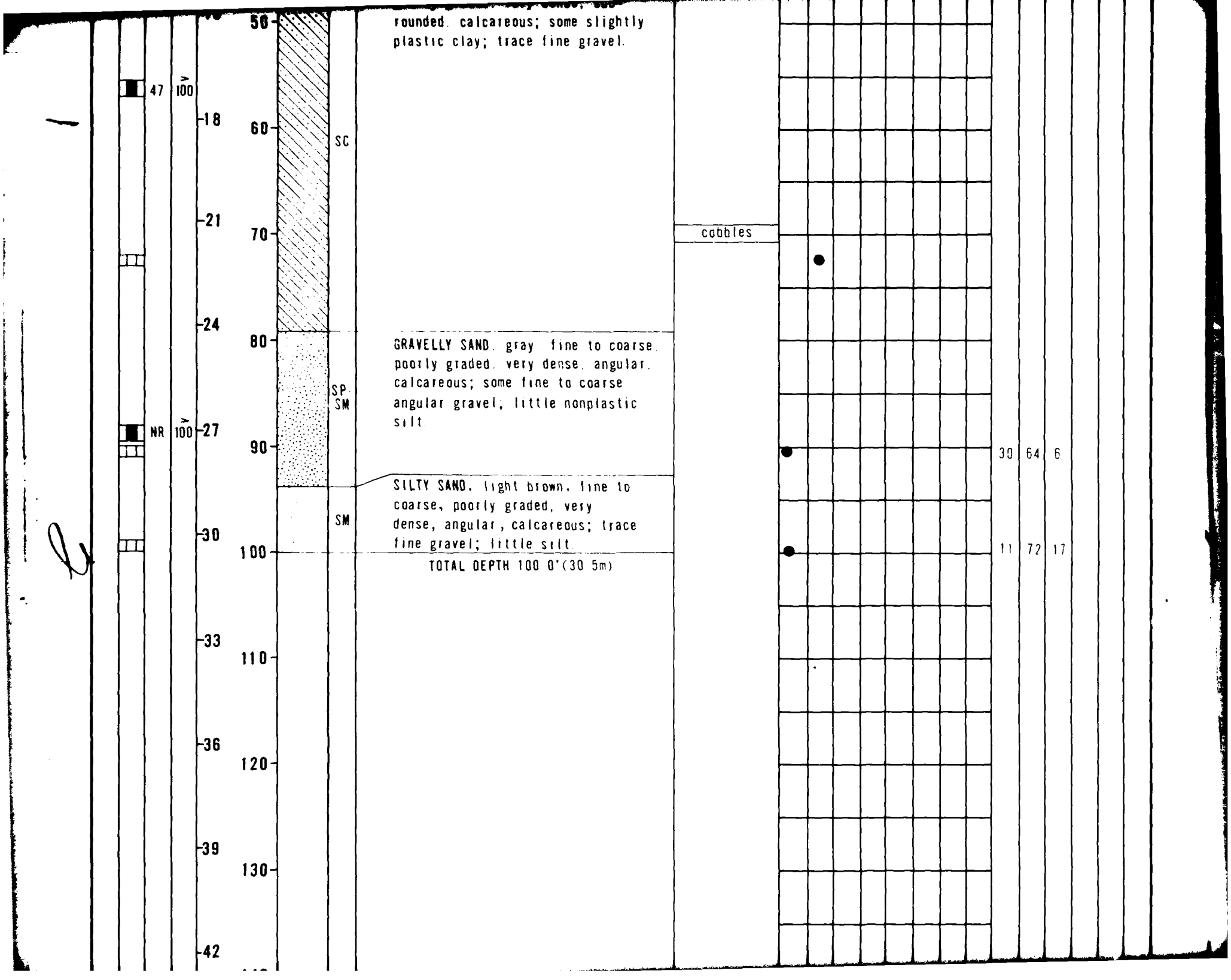
AFV-06

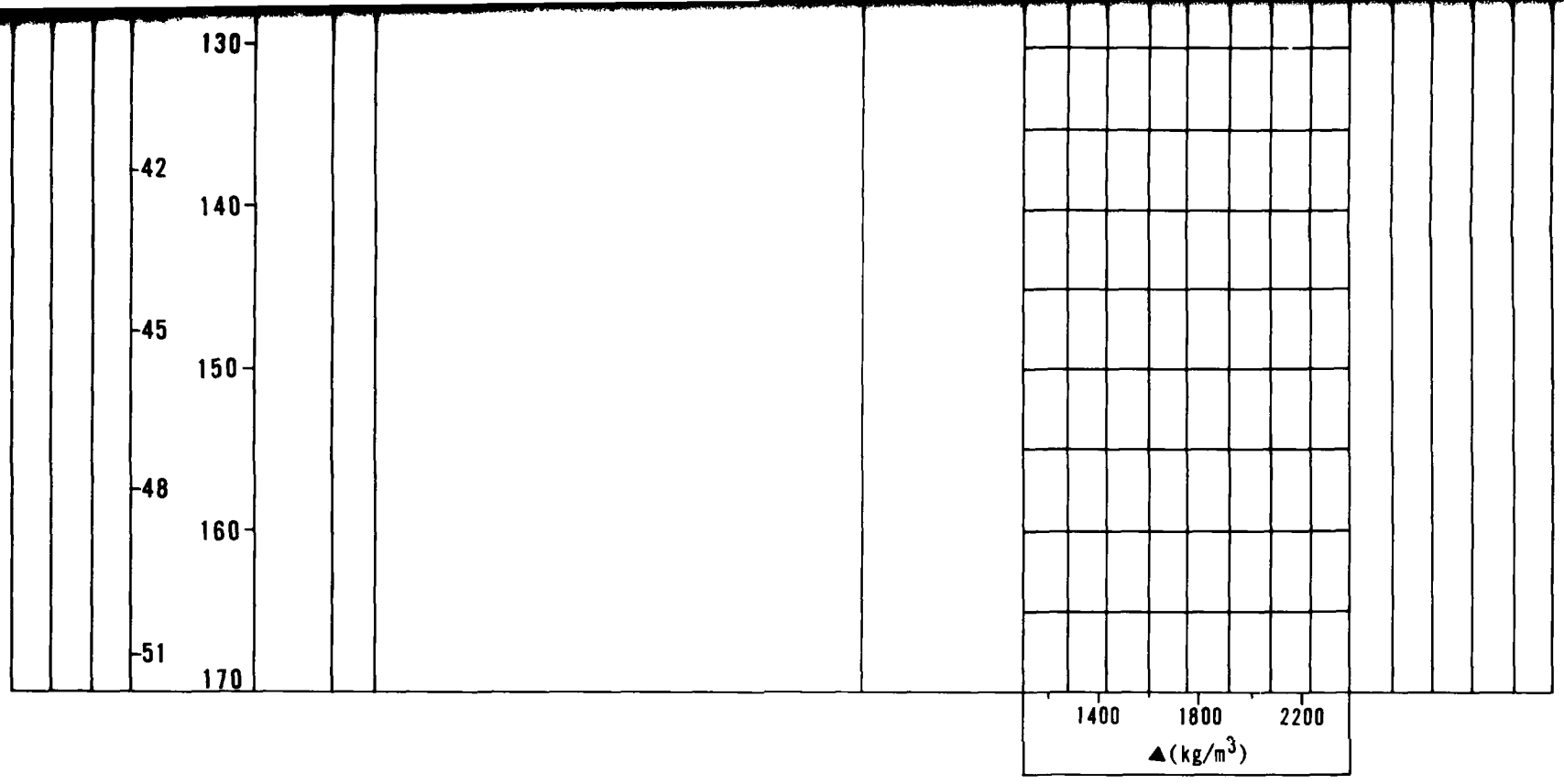
CHECKED BY _____ APPROVED BY _____

15 JUN 80

SAMPLE TYPE	% RECOVERY	N VALUE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	SOIL DESCRIPTION	REMARKS	▲(pcf) 80 90 100 110 120 130 140 / ● (%) 5 10 15 20 25 30 35	SIEVE ANALYSIS GR	SA	FI	LL	PI
			0	0			GRAVELLY SAND, brown, fine to coarse, poorly graded, medium dense to dense subangular, calcareous; little fine subangular gravel; trace nonplastic silt.							
			3	10										
			6	20		SM			●	19	69	12		
			9	30				cobbles						
			12	40										
			15	50			CLAYEY SAND brown, fine to coarse poorly graded very dense, subrounded calcareous; some slightly plastic clay; trace fine gravel.							
■	47	100/6"	18											

FN-TR-2--RV


47 100
NR 100
50
60
70
80
90
100
110
120
130
18
21
24
27
30
33
36
39
42
SC
SP SM
SM
rounded. calcareous; some slightly plastic clay; trace fine gravel.
GRAVELLY SAND. gray. fine to coarse. poorly graded. very dense. angular. calcareous; some fine to coarse angular gravel; little nonplastic silt.
SILTY SAND. light brown. fine to coarse, poorly graded, very dense, angular, calcareous; trace fine gravel; little silt.
TOTAL DEPTH 100 0'(30 5m)
cobbles
30 64 6
11 72 17



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N - STANDARD PENETRATION RESISTANCE
- ▲ - DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● - MOISTURE CONTENT (ASTM: D-2216-71)
- NR - NO RECOVERY

BORING DETAILS

ELEVATION	:5560'(1695m)
SURFICIAL GEOLOGIC UNIT	:A5y
DATE DRILLED	:3-6 August 1977
DRILLING METHOD	:Becker Percussion
HOLE DIAMETER	:5 1 2" (140mm)
WATER LEVEL	:Not Encountered

LOG OF BORING RV-B-10
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMO

FIGURE II-4-10

FUGRO NATIONAL, INC.

AFV-06

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15 JUN 80

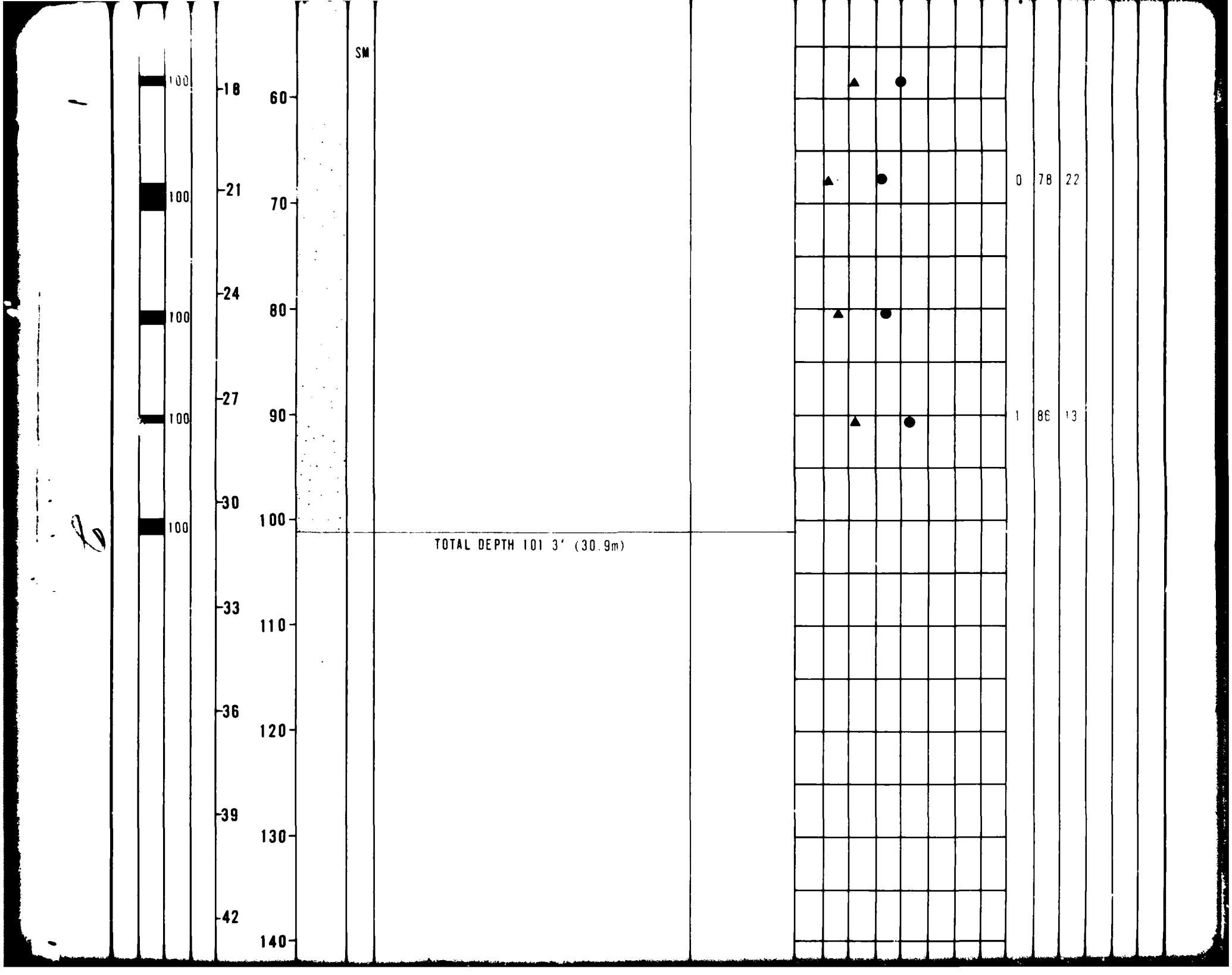
FN TR-22 RV

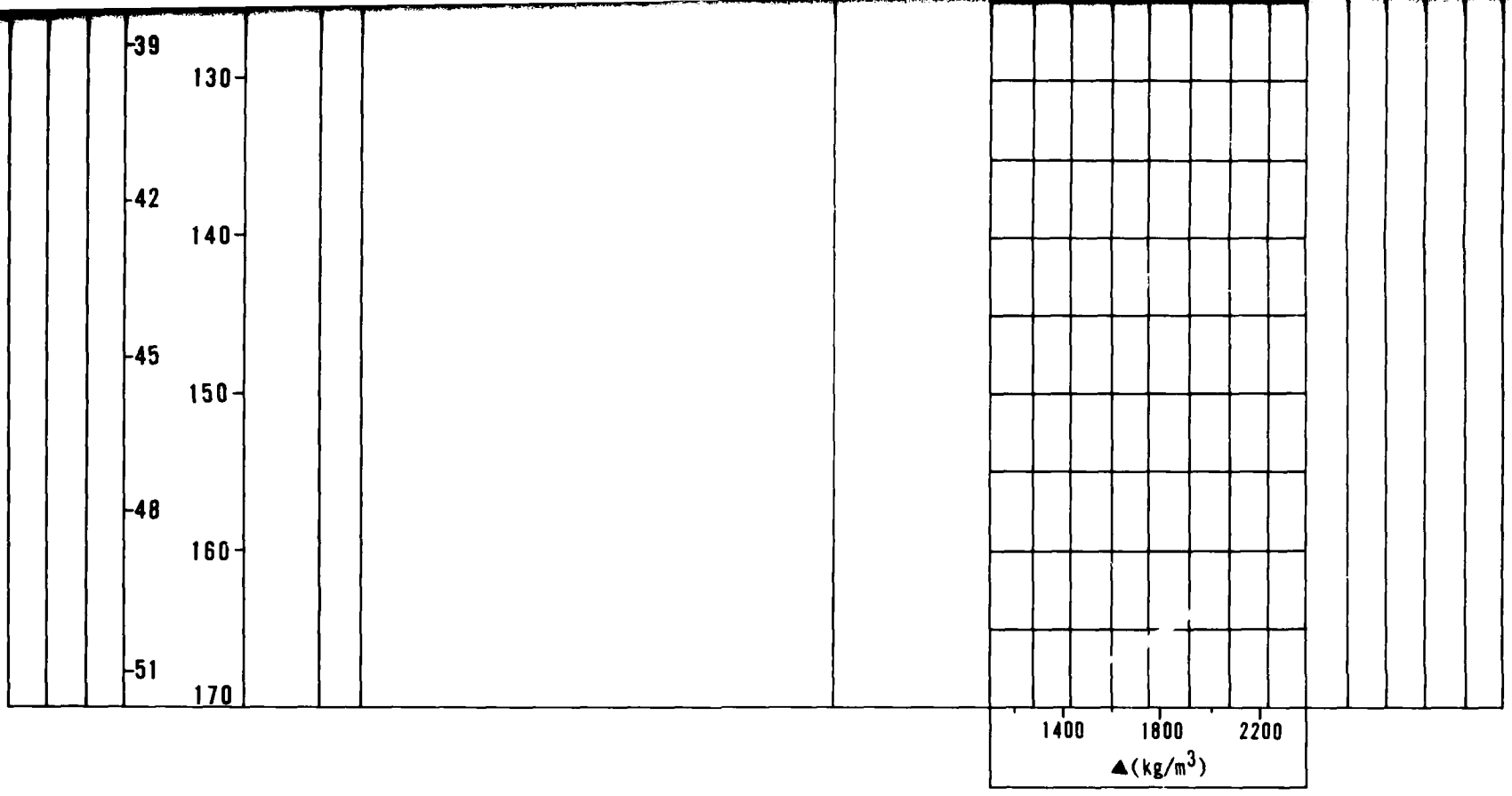
SAMPLE TYPE	% RECOVERY	N VALUE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	SOIL DESCRIPTION	REMARKS
			0	0			GRAVELLY SAND, light brown gray, fine to coarse, poorly to well graded, loose to very dense, sub-angular to subrounded, calcareous; some fine to coarse subangular gravel; trace to some silt, layer of sandy gravel (9.0'-13.0').	boulders to 24" size
	100					SM		
	100		3	10		GP GM		boulder 6" size
	100					SW-SM		drill chatter
	100		6	20			SILTY SAND, brown gray, fine to coarse, poorly graded, very dense, calcareous; little to some silt; trace fine gravel; occasional cemented layers throughout	
	100							
	100		9	30				
	100		12	40				
	100		15	50				
						SM		

▲(pcf) 80 90 100 110 120 130 140

● (%) 5 10 15 20 25 30 35

SIEVE ANALYSIS				
GR	SA	FI	LL	PI
35	46	19		
21	46	33		
61	27	12		
22	67	11		
21	64	15		
1	71	28		
5	73	22		


100
100
100
100
100
18
21
24
27
30
33
36
39
42
60
70
80
90
100
110
120
130
140
SM
TOTAL DEPTH 101 3' (30.9m)
0 78 22
1 86 13



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N – STANDARD PENETRATION RESISTANCE
- ▲ – DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● – MOISTURE CONTENT (ASTM: D-2216-71)
- NR – NO RECOVERY

BORING DETAILS

ELEVATION	:5770' (1759m)
SURFICIAL GEOLOGIC UNIT	:A5i
DATE DRILLED	:9 August 1977
DRILLING METHOD	:Rotary Wash
HOLE DIAMETER	:4 7 8" (124mm)
WATER LEVEL	:Not Encountered

LOG OF BORING RY-8-12
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-4-11

FUGRO NATIONAL, INC.

AFV-08

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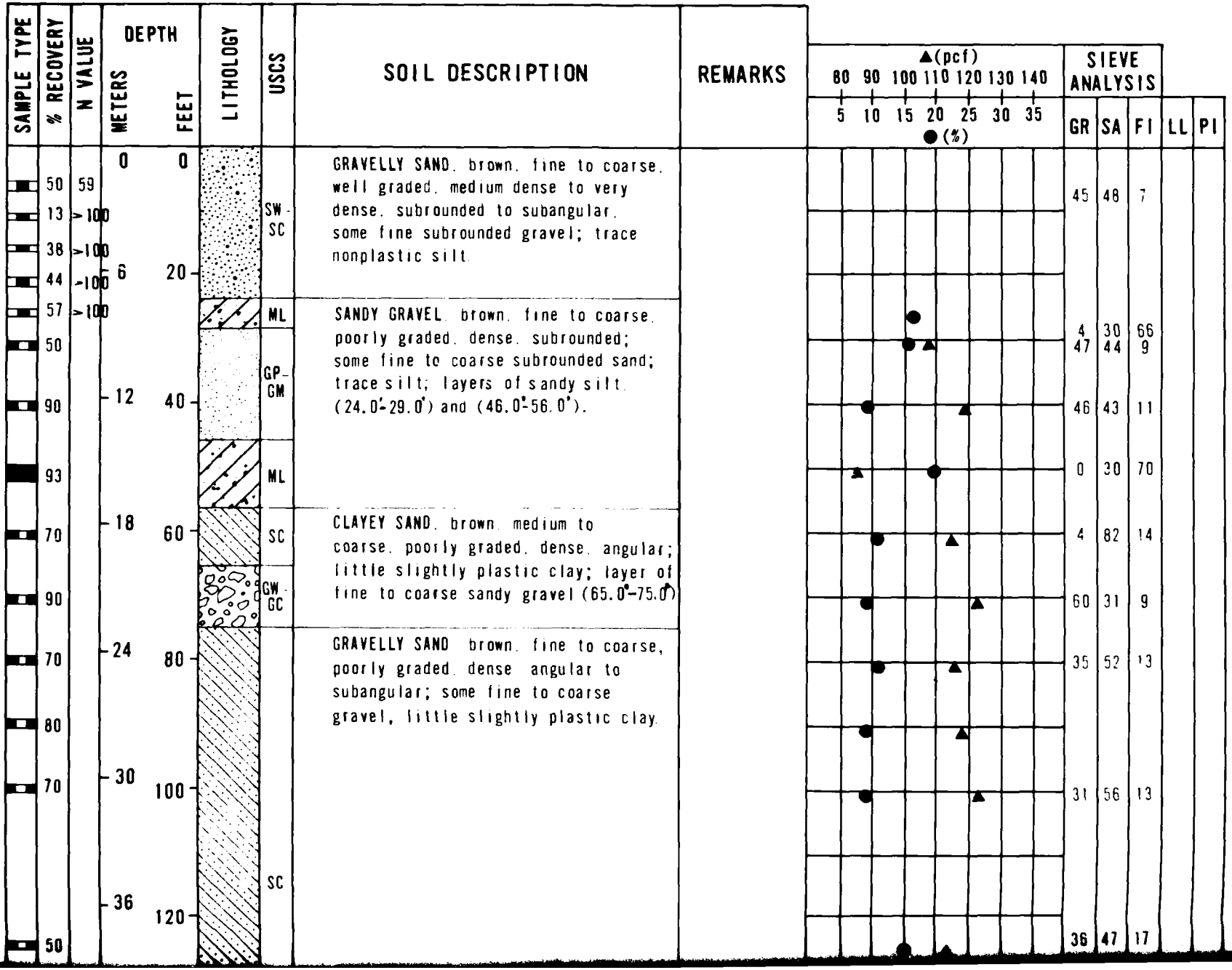
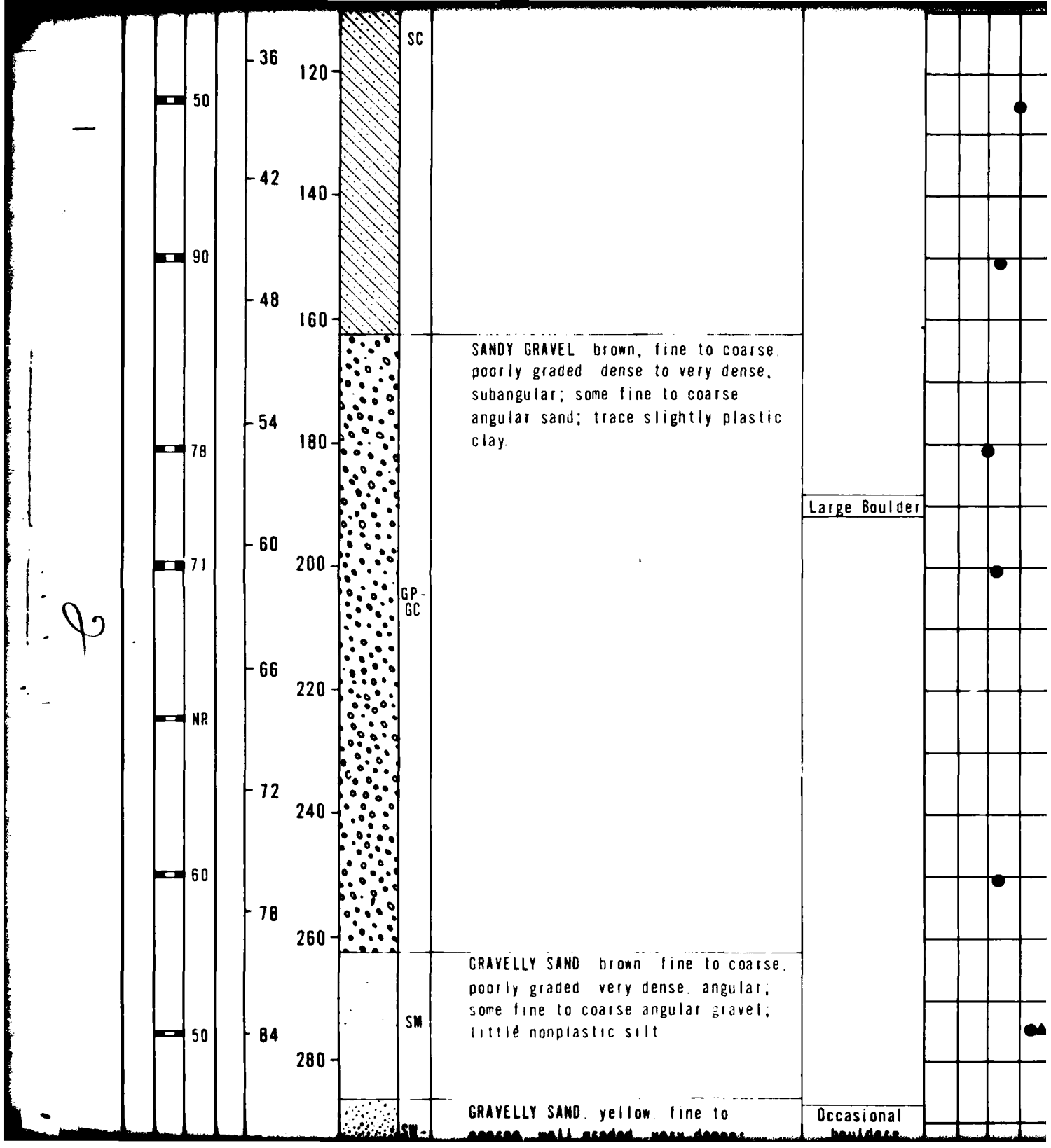
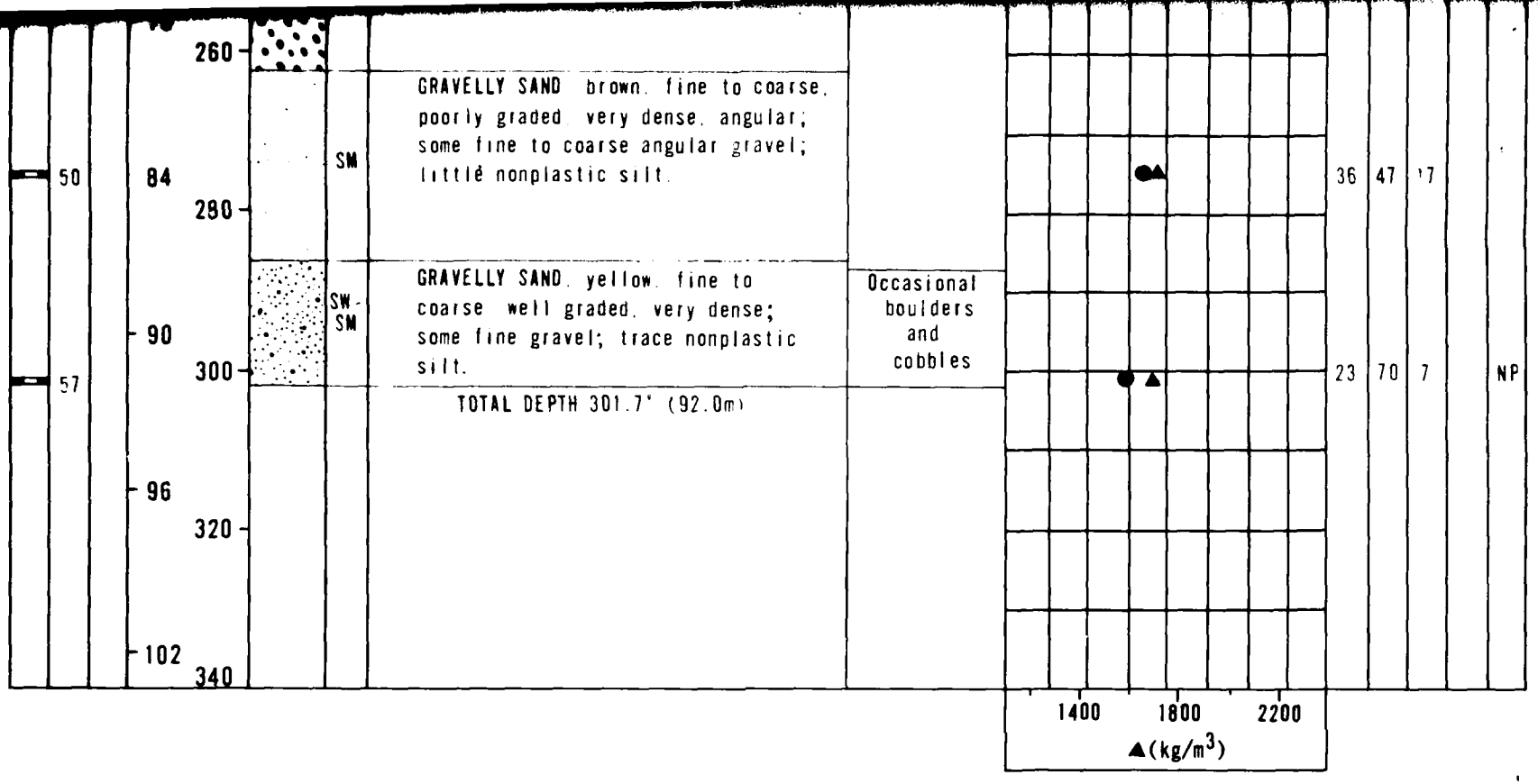
FN-TR-27-RV




50
90
78
71
NR
60
50
36
42
48
54
60
66
72
78
84
120
140
160
180
200
220
240
260
280
SC
GP-GC
SM
SM
SANDY GRAVEL brown, fine to coarse, poorly graded dense to very dense, subangular; some fine to coarse angular sand; trace slightly plastic clay.
GRAVELLY SAND brown fine to coarse, poorly graded very dense, angular; some fine to coarse angular gravel; little nonplastic silt
GRAVELLY SAND, yellow, fine to
Large Boulder
Occasional



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N – STANDARD PENETRATION RESISTANCE
- ▲ – DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● – MOISTURE CONTENT (ASTM: D-2216-71)
- NR – NO RECOVERY

BORING DETAILS

ELEVATION	:5545' (1690m)
SURFICIAL GEOLOGIC UNIT	:A5y
DATE DRILLED	:18-22 August 1977
DRILLING METHOD	:Rotary Wash
HOLE DIAMETER	:4 7/8" (124mm)
WATER LEVEL	:Not Encountered

LOG OF BORING RV-B-13
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMO

FIGURE II-4-12

FUGRO NATIONAL, INC.

AFV-08

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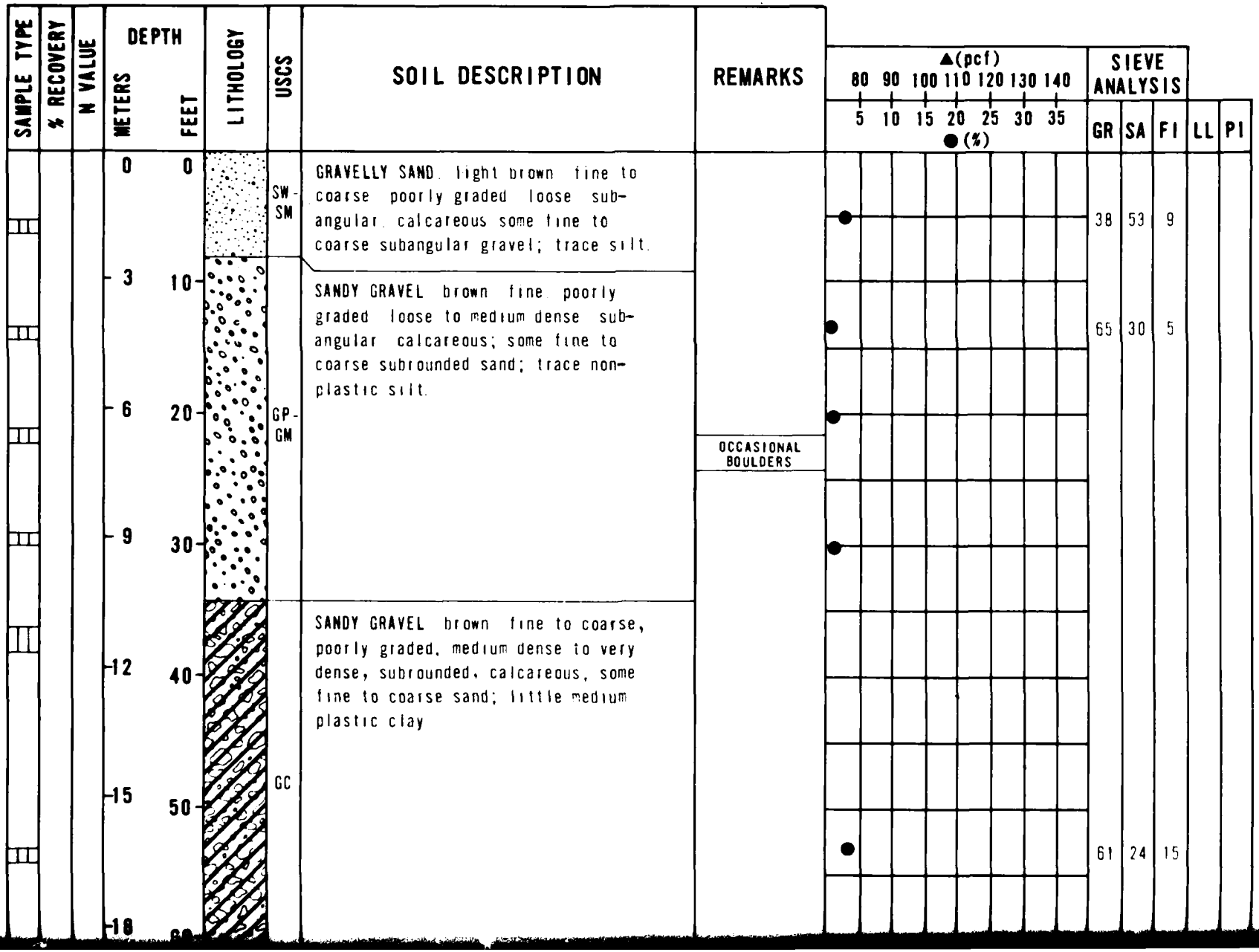
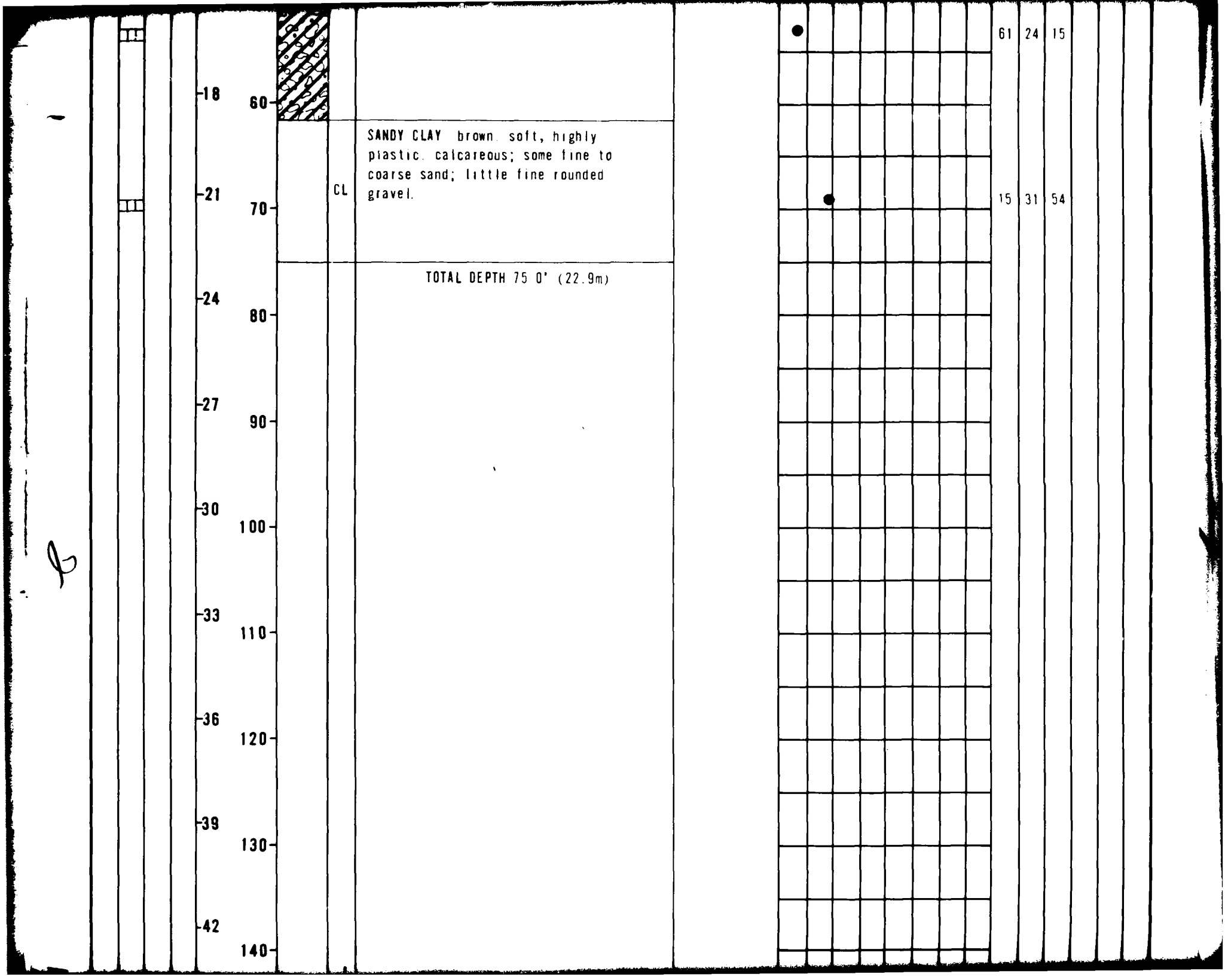
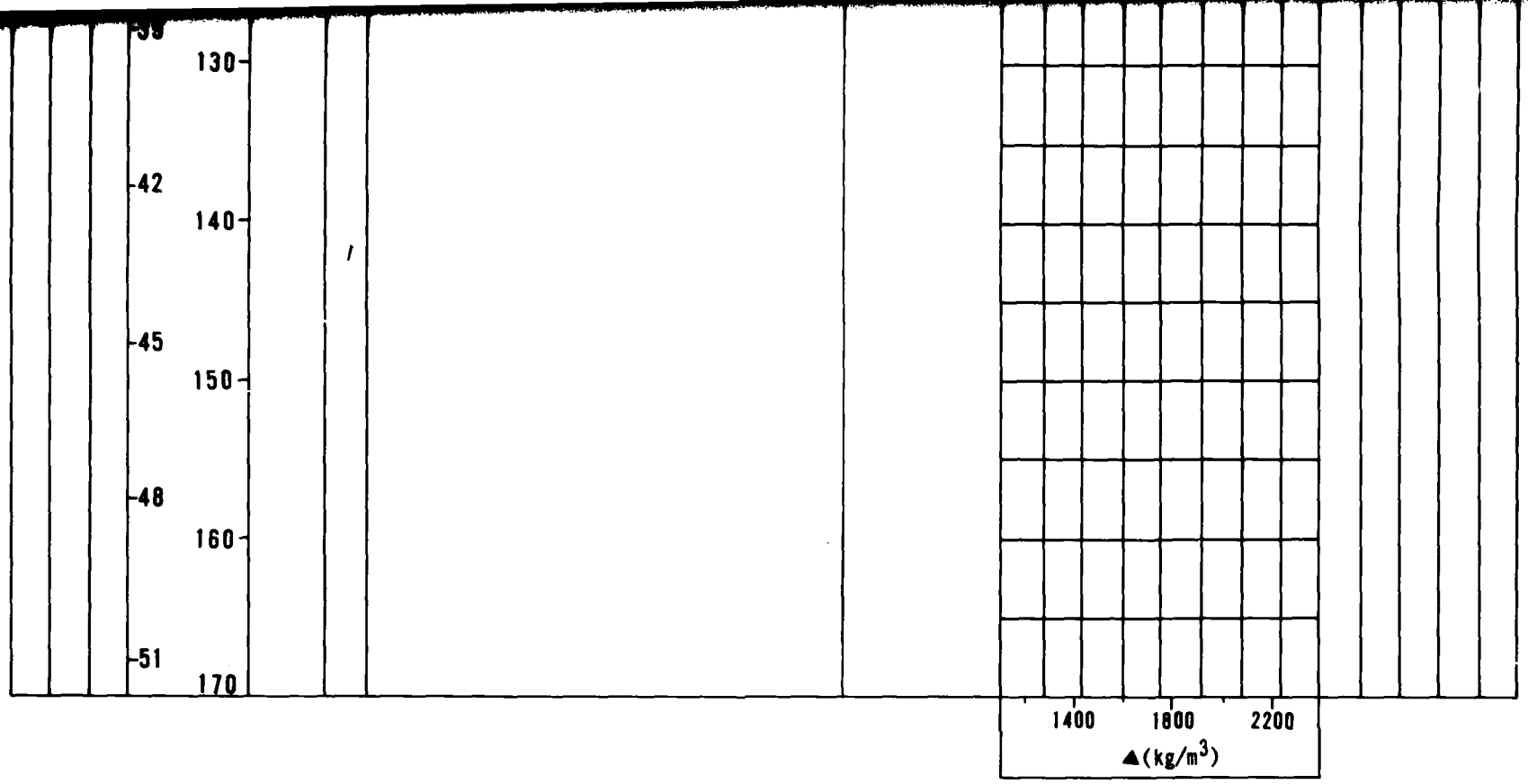
FN-TR-27 RV




18
21
24
27
30
33
36
39
42
60
70
80
90
100
110
120
130
140
CL
SANDY CLAY brown soft, highly plastic calcareous; some fine to coarse sand; little fine rounded gravel.
TOTAL DEPTH 75 0' (22.9m)
61 24 15
15 31 54



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N - STANDARD PENETRATION RESISTANCE
- ▲ - DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● - MOISTURE CONTENT (ASTM: D-2216-71)
- NR - NO RECOVERY

BORING DETAILS

ELEVATION	: 5940' (1811m)
SURFICIAL GEOLOGIC UNIT	: A5i
DATE DRILLED	: 23 July 1977
DRILLING METHOD	: Becker Percussion
HOLE DIAMETER	: 5 1 2" (140mm)
WATER LEVEL	: Not Encountered

LOG OF BORING RV-B-14
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-4-13

FUGRO NATIONAL, INC.

AFV-06

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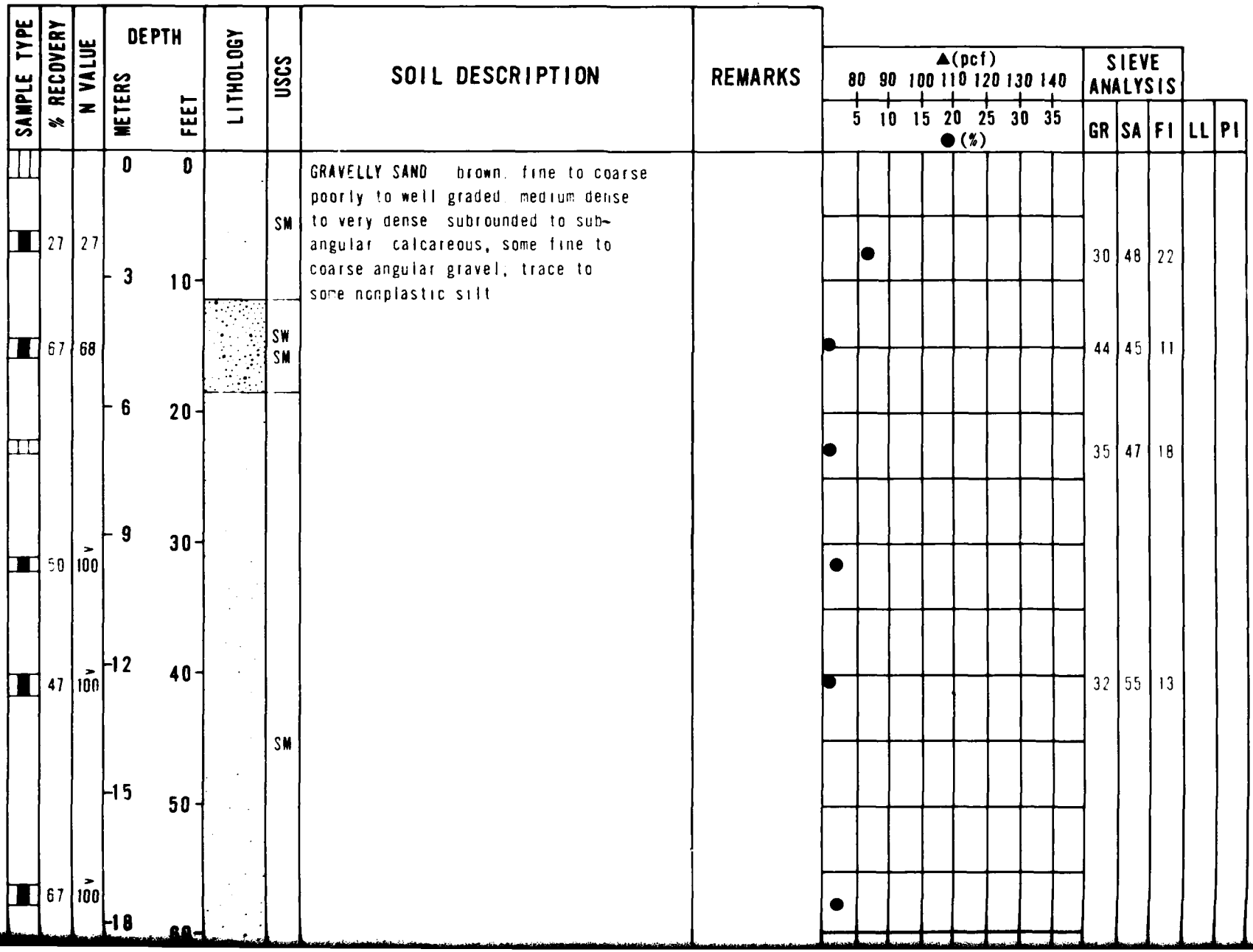
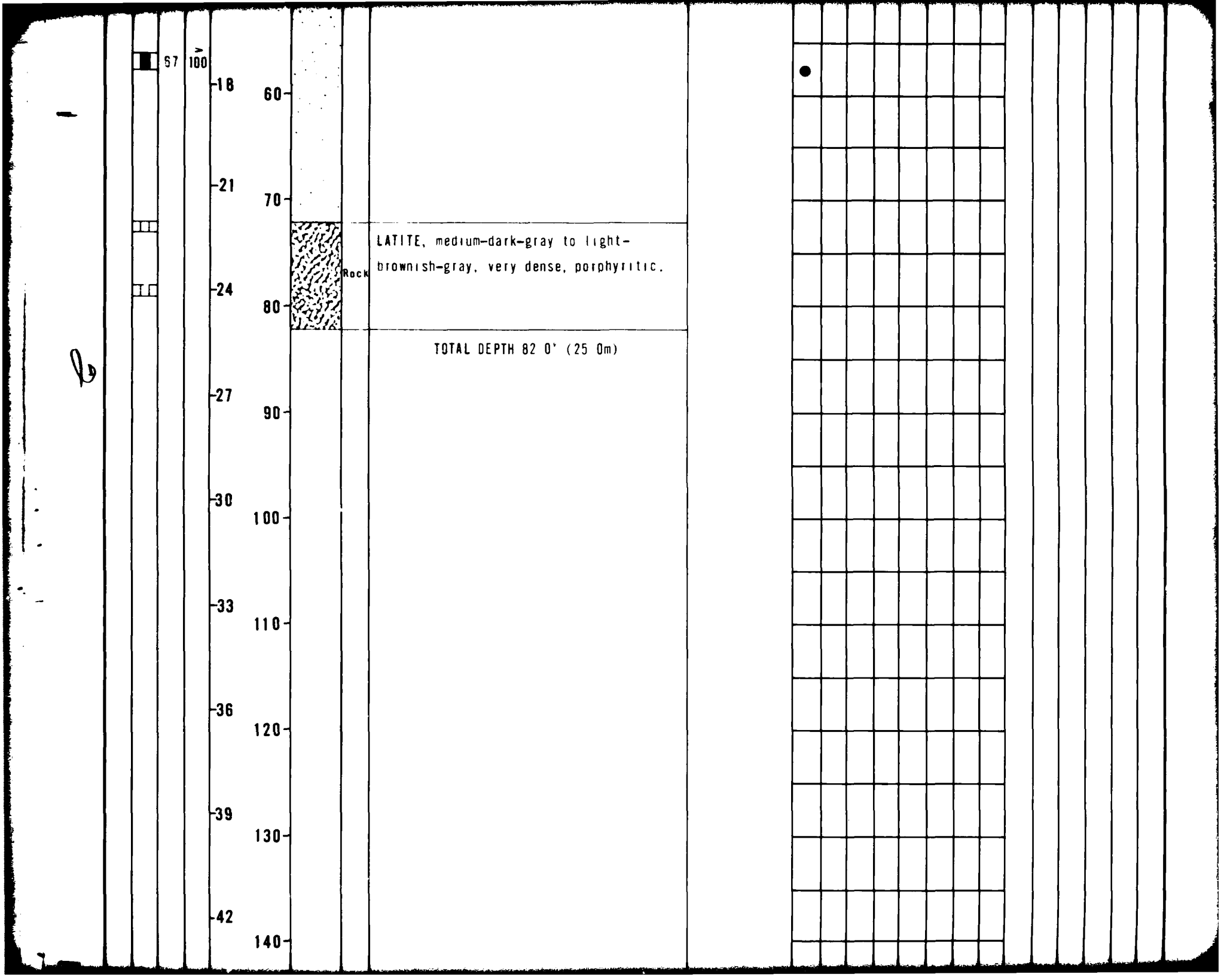
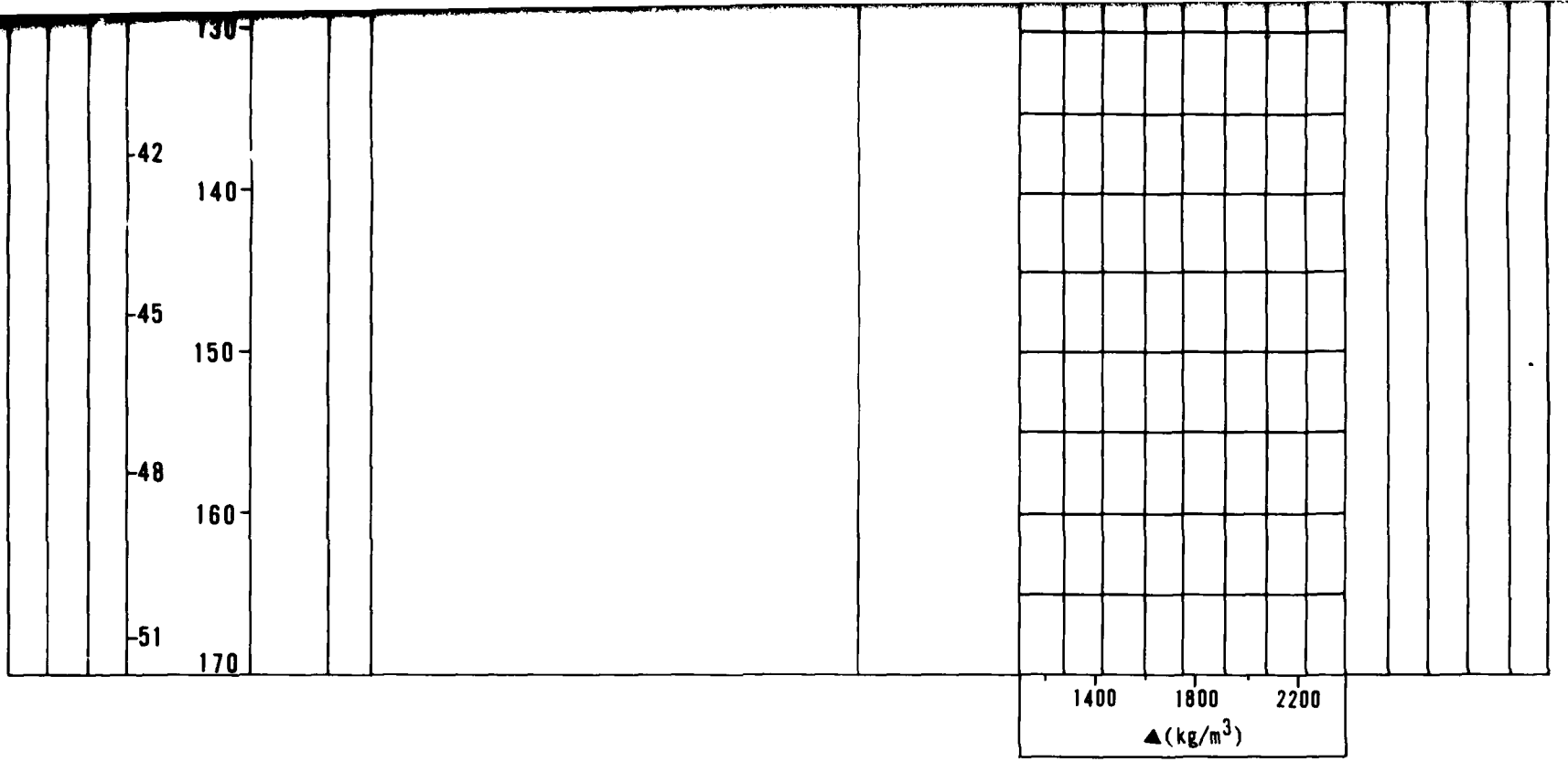
15 JUN 80

FN-IR 27-RV




67
100
18
21
24
27
30
33
36
39
42
60
70
80
90
100
110
120
130
140
Rock
LATITE, medium-dark-gray to light-brownish-gray, very dense, porphyritic.
TOTAL DEPTH 82 0' (25 0m)



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N – STANDARD PENETRATION RESISTANCE
- ▲ – DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● – MOISTURE CONTENT (ASTM: D-2216-71)
- NR – NO RECOVERY

BORING DETAILS

ELEVATION	: 5555' (1693m)
SURFICIAL GEOLOGIC UNIT	: A5y
DATE DRILLED	: 6-7 August 1977
DRILLING METHOD	: Becker Percussion
HOLE DIAMETER	: 5 1 2" (140mm)
WATER LEVEL	: Not Encountered

LOG OF BORING RV-B-15
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMO

FIGURE II-4-14

FUGRO NATIONAL, INC.

AFV-06

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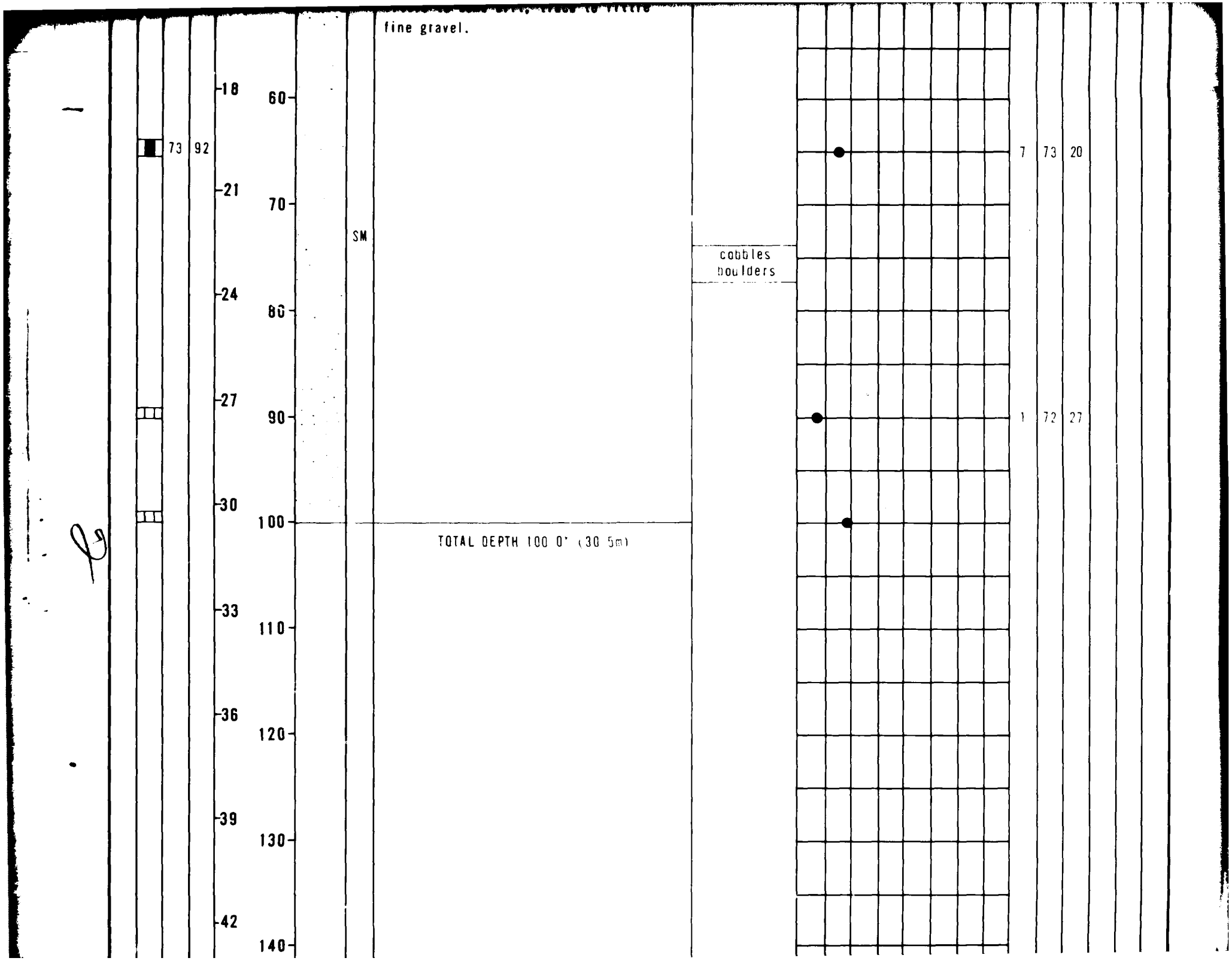
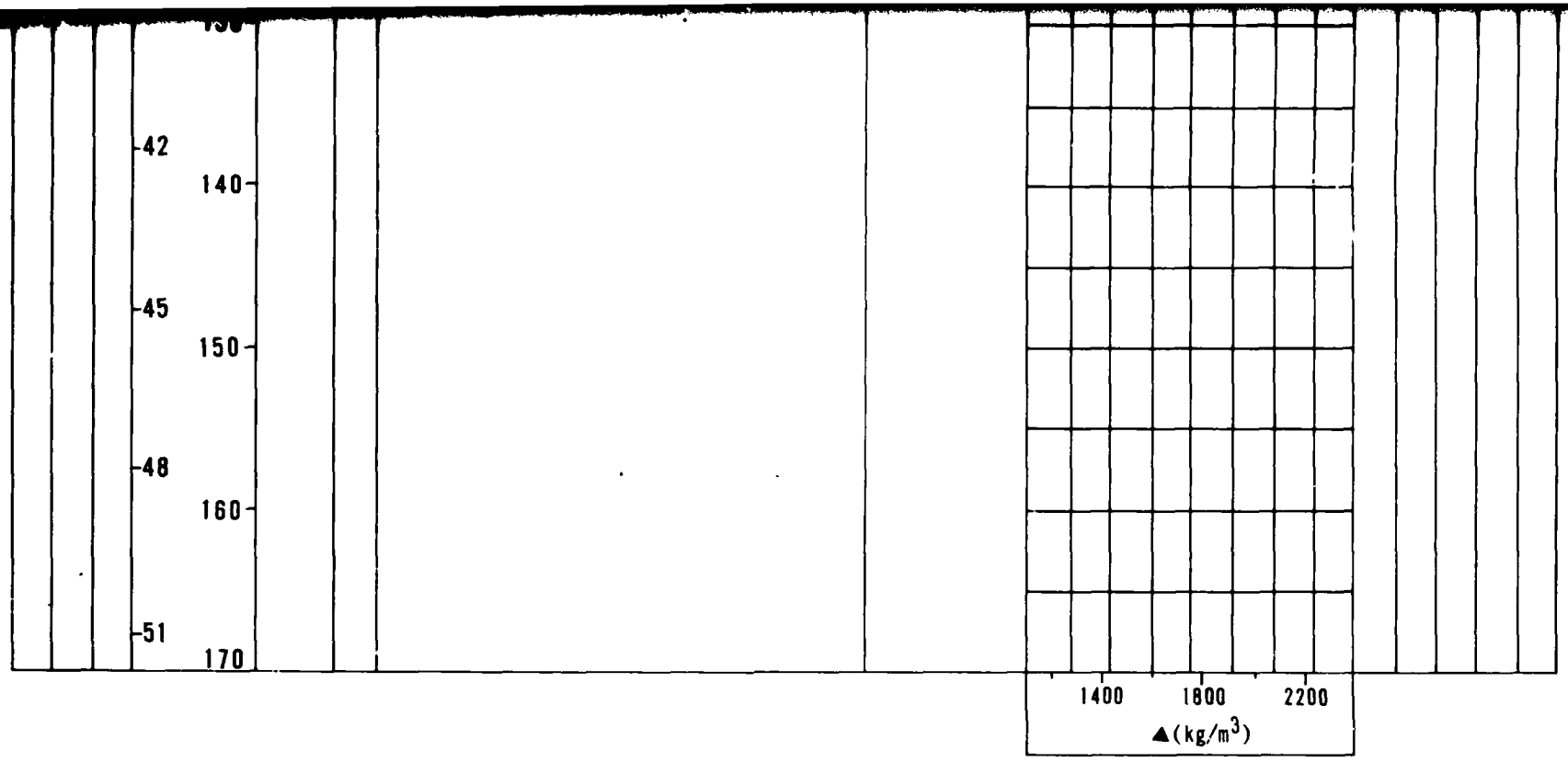
15 JUN 80

FN-TR 27 RV

SAMPLE TYPE	% RECOVERY	N VALUE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	SOIL DESCRIPTION	REMARKS	▲(pcf) 80 90 100 110 120 130 140 / ● (%) 5 10 15 20 25 30 35	SIEVE ANALYSIS GR	SA	FI	LL	PI
			0	0			SANDY GRAVEL, brown, fine to coarse well graded, loose to medium dense subrounded, some fine to coarse subangular to subrounded sand		●	71	27	2		
			3	10					●					
			6	20		GW			●					
			9	30					●	62	35	3		
			12	40					●					
	60	100/6"	15	50			SILTY SAND brown fine to coarse poorly graded dense to very dense little to some silt; trace to little fine gravel.		●	17	62	21		
			18	60										


fine gravel.
18
60
73 92
21
70
SM
cobbles
boulders
24
80
7 73 20
27
90
1 72 27
30
100
TOTAL DEPTH 100 0' (30 5m)
33
110
36
120
39
130
42
140



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N - STANDARD PENETRATION RESISTANCE
- ▲ - DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● - MOISTURE CONTENT (ASTM: D-2216-71)
- NR - NO RECOVERY

BORING DETAILS

ELEVATION	: 5380' (1640m)
SURFICIAL GEOLOGIC UNIT	: A5y
DATE DRILLED	: 8-9 August 1977
DRILLING METHOD	: Becker Percussion
HOLE DIAMETER	: 5 1 2" (140mm)
WATER LEVEL	: Not Encountered

LOG OF BORING RV-B-16
RALSTON VALLEY, NEVADA

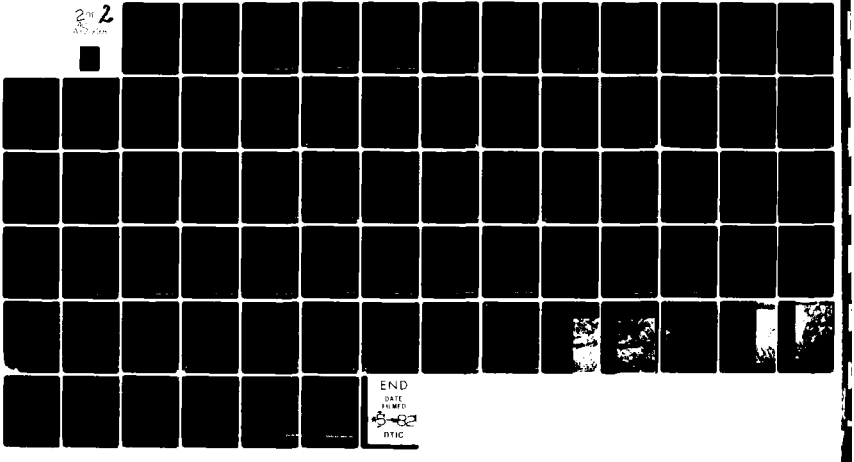
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMO

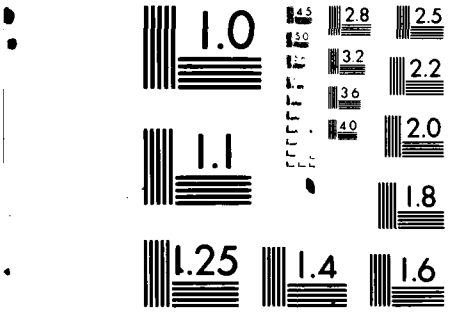
FIGURE II-4-15

FUGRO NATIONAL, INC.

AFV-06

AD-A112 998 FUGRO NATIONAL INC LONG BEACH CA F/G 8/13
MX SITING INVESTIGATION. GEOTECHNICAL EVALUATION. VERIFICATION --ETC(U)
JUN 80 F04704-80-C-0006
UNCLASSIFIED FN-TR-27-RV-2-VOL-2 NL





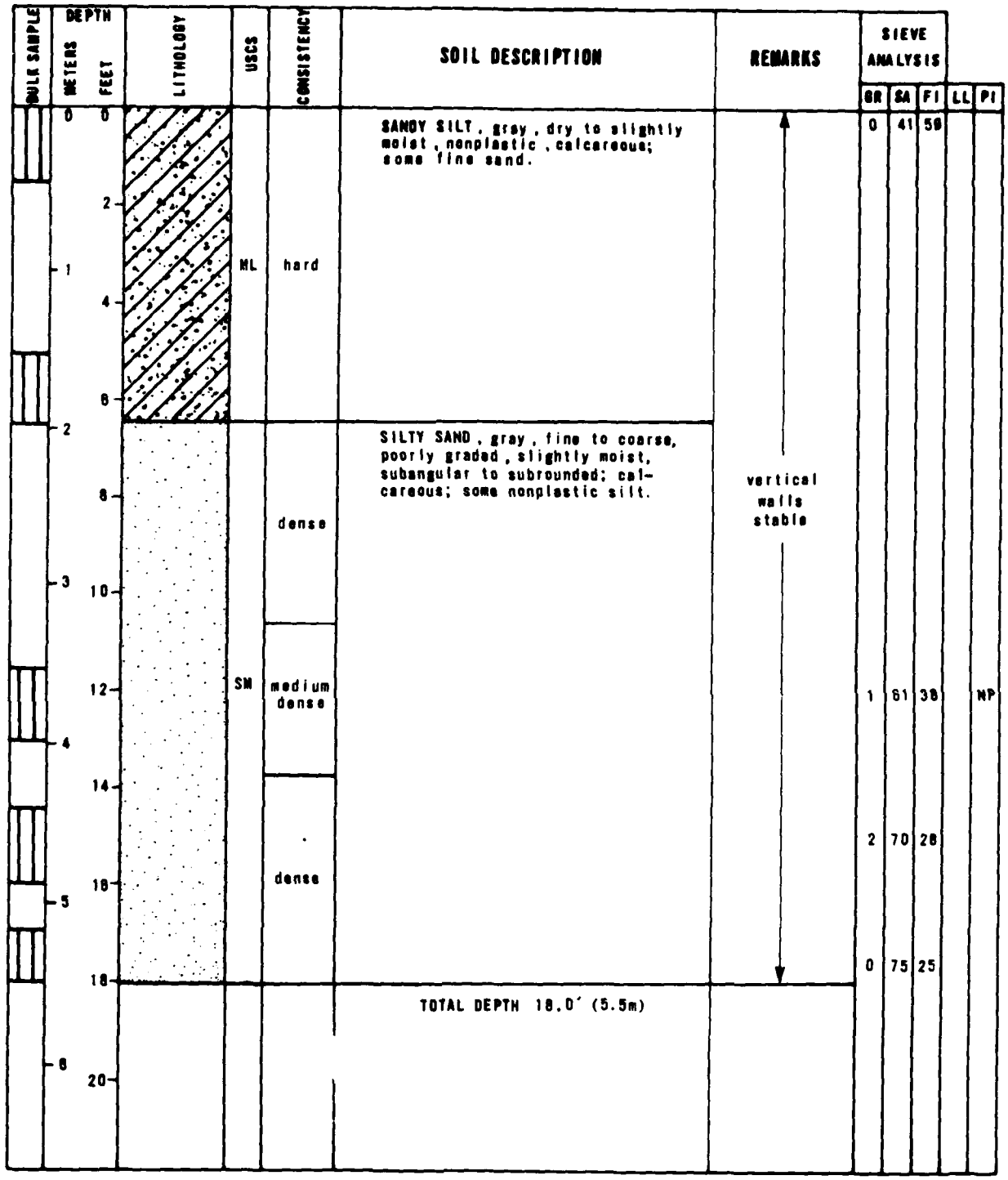
SECTION 5.0

TRENCH LOGS

5.0 EXPLANATIONS OF TRENCH LOGS

See Section 4.0, "Boring Logs", for explanations.

FN-TR-27-RV



TRENCH DETAILS

SURFACE ELEVATION	: 5180' (1579m)
DATE EXCAVATED	: 16 August 1977
SURFICIAL GEOLOGIC UNIT	: A4
TRENCH LENGTH	: 60.0'(18.0m)
TRENCH ORIENTATION	: NE-SW

LOG OF TRENCH RV-T-1
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-5-1

WOODWARD-NATIONAL, INC.

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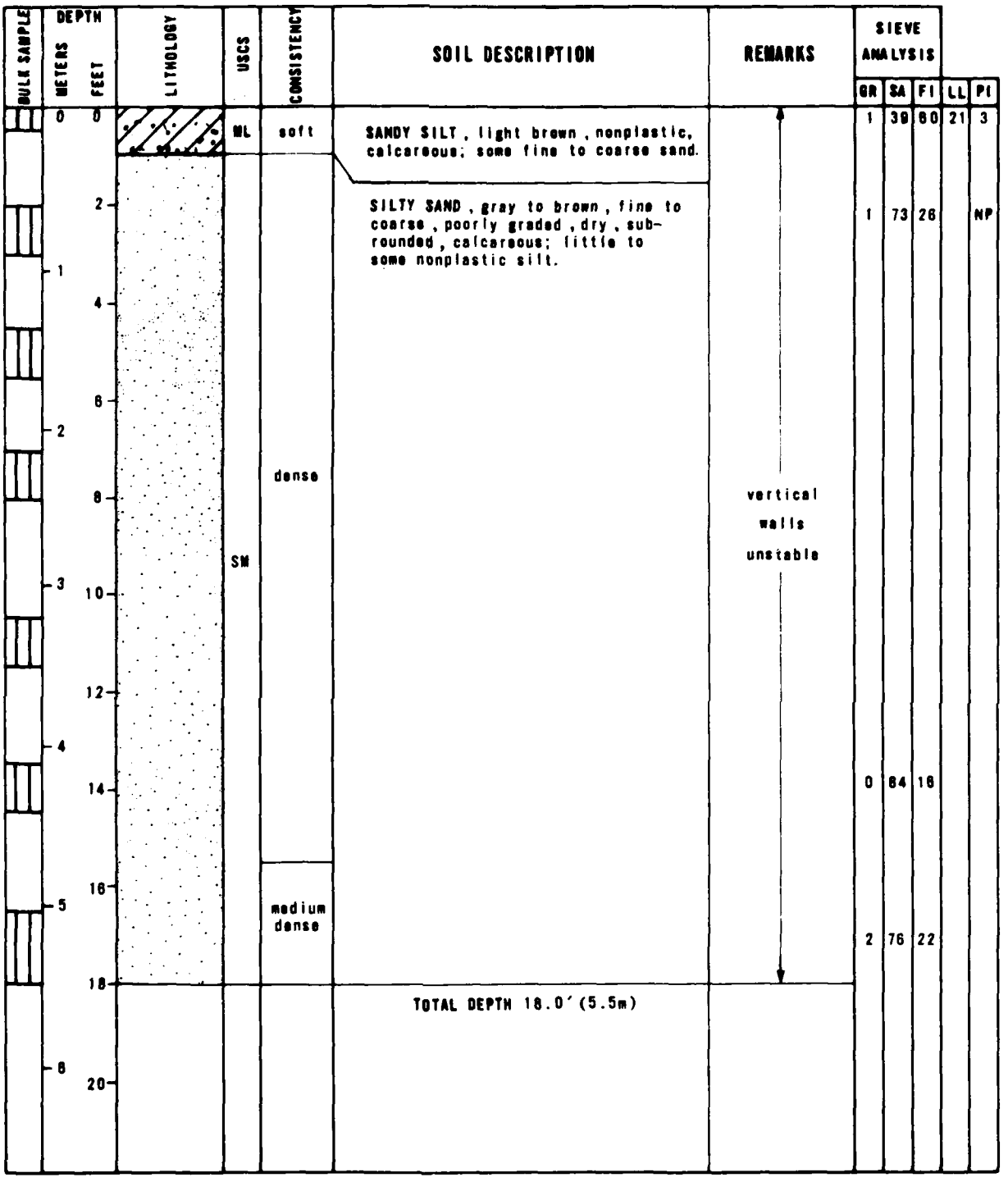
AFV-04

FN-TR-27-RV



TRENCH DETAILS

SURFACE ELEVATION : 5240' (1597m)
DATE EXCAVATED : 16 August 1977
SURFICIAL GEOLOGIC UNIT : A5y/A4
TRENCH LENGTH : 54.0'(16.5m)
TRENCH ORIENTATION : NE-SW

LOG OF TRENCH RV-T-2
RALSTON VALLEY, NEVADA

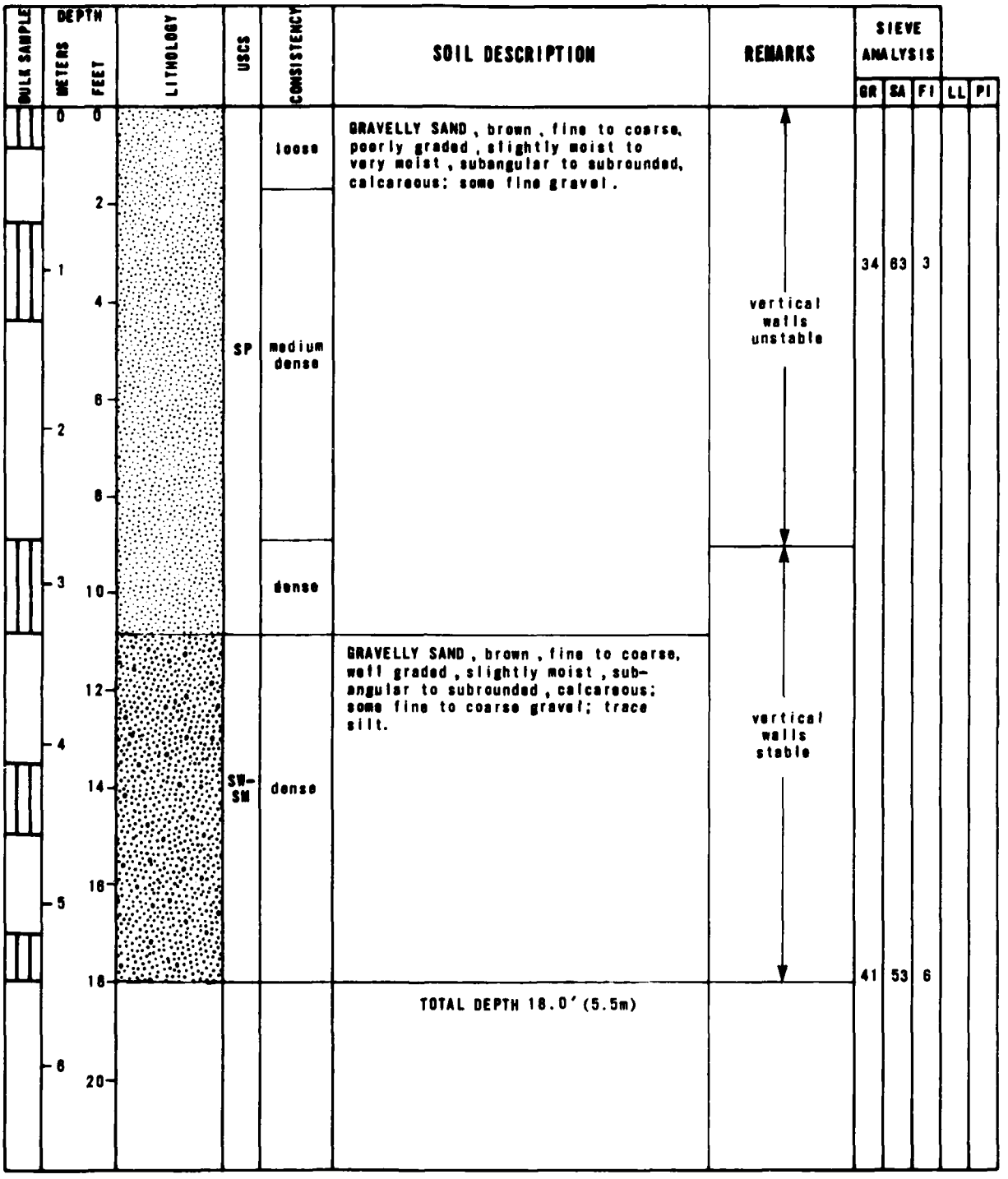
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-5-2

WOODWARD-CLYDE CONSULTANTS

15 JUN 80

AFV-04



TRENCH DETAILS

SURFACE ELEVATION : 5335' (1628m)
DATE EXCAVATED : 20 August 1977
SURFICIAL GEOLOGIC UNIT : A5y
TRENCH LENGTH : 56.0'(17.1m)
TRENCH ORIENTATION : E-W

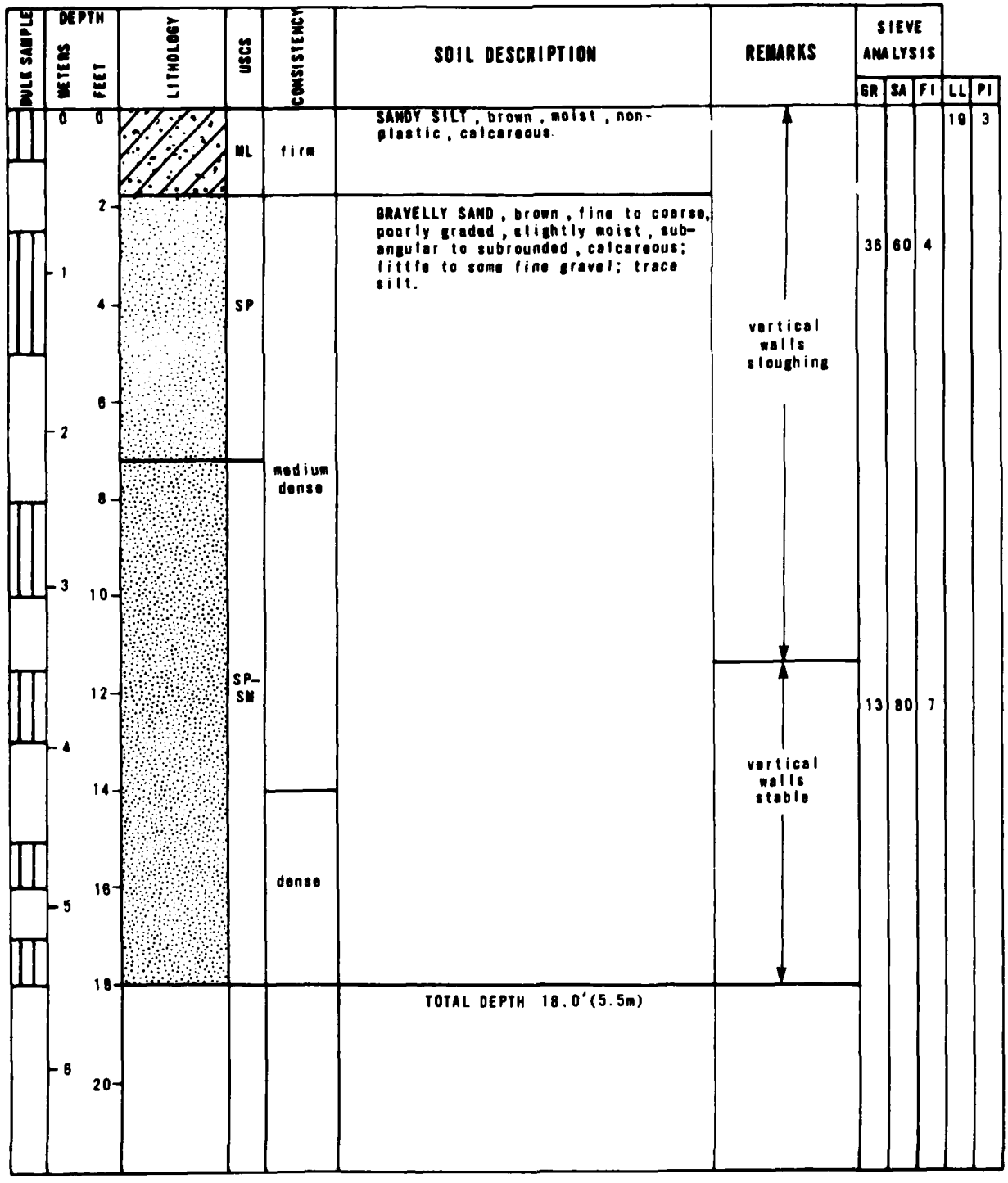
LOG OF TRENCH RV-T-3
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - [redacted]

FIGURE II-5-3

[redacted] NATIONAL, INC.

FN-TR-27-RV



TRENCH DETAILS

SURFACE ELEVATION : 5285' (1611m)
DATE EXCAVATED : 19 August 1977
SURFICIAL GEOLOGIC UNIT : A5y/A4
TRENCH LENGTH : 69.0' (21.0m)
TRENCH ORIENTATION : NW-SE

LOG OF TRENCH RV-T-4
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

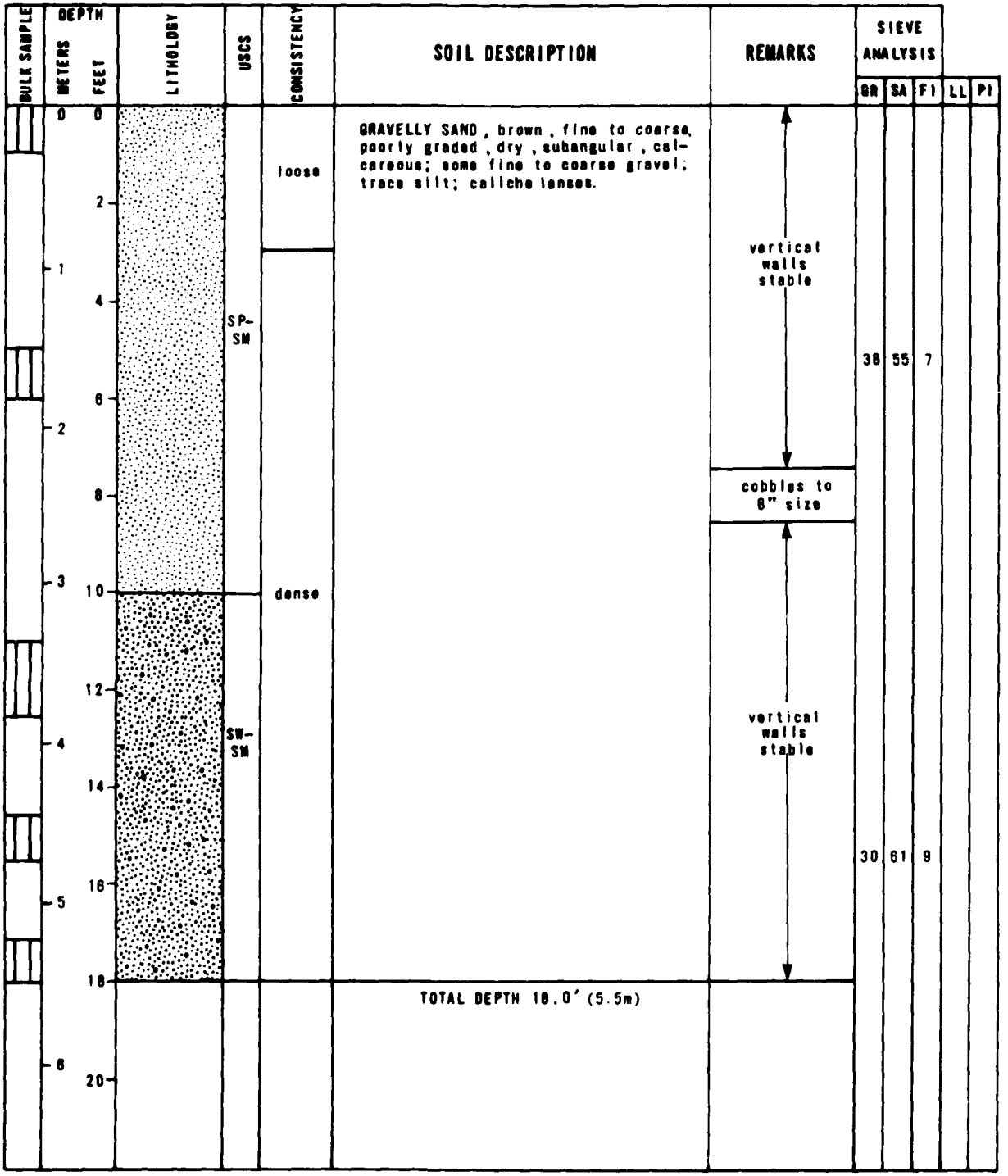
FIGURE II-5-4

FUGRO NATIONAL, INC.

15 JUN 80

AFV-04

FN-TR-27-RV



TRENCH DETAILS

SURFACE ELEVATION	: 5590' (1704m)
DATE EXCAVATED	: 16 August 1977
SURFICIAL GEOLOGIC UNIT	: A5y
TRENCH LENGTH	: 65.0'(19.8m)
TRENCH ORIENTATION	: NW-SE

LOG OF TRENCH RV-T-5
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE II-5-5

WOODWARD-NATIONAL, INC.

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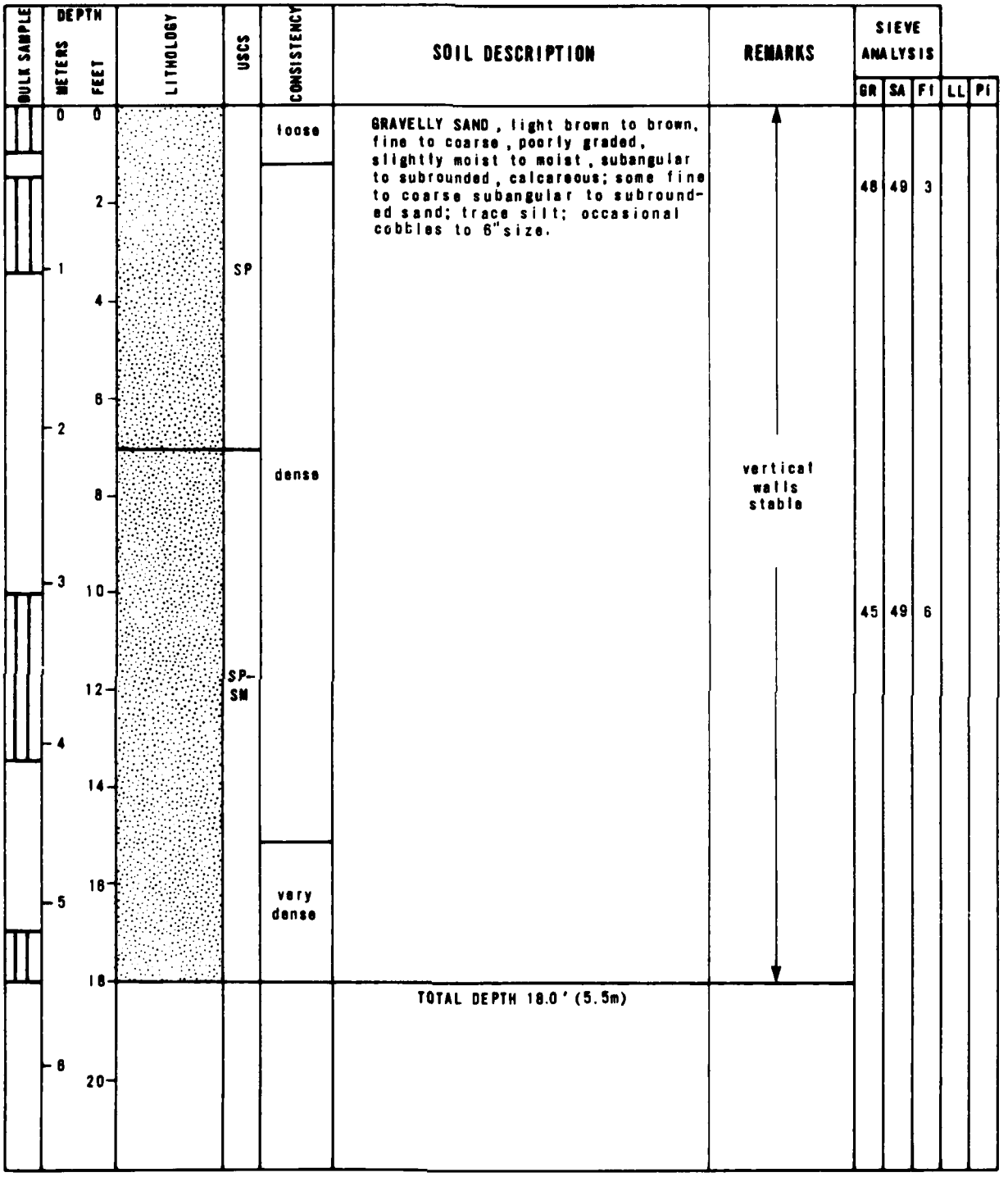
15 JUN 80

AFV-04

FN-TR-27-RV



TRENCH DETAILS

SURFACE ELEVATION	: 5545' (1690m)
DATE EXCAVATED	: 18 August 1977
SURFICIAL GEOLOGIC UNIT	: A5y
TRENCH LENGTH	: 65.0' (19.8m)
TRENCH ORIENTATION	: E-W

LOG OF TRENCH RV-T-6
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-5-6

WOODWARD-CLYDE CONSULTANTS

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15 JUN 80

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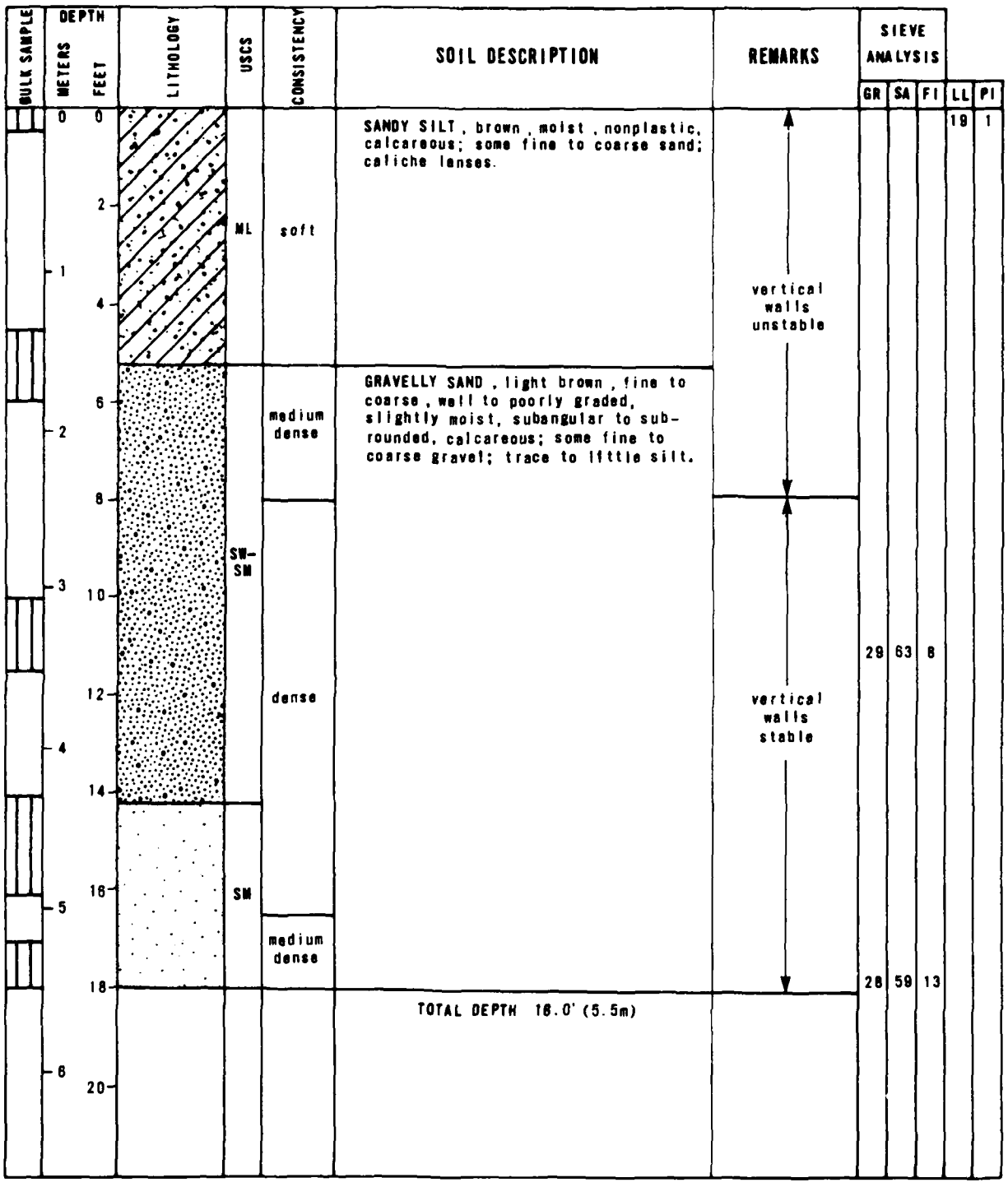
FN-TR-27-RV



TRENCH DETAILS

SURFACE ELEVATION	: 5940' (1811m)
DATE EXCAVATED	: 19 August 1977
SURFICIAL GEOLOGIC UNIT	: A5i
TRENCH LENGTH	: 68.0' (21.0m)
TRENCH ORIENTATION	: NE-SW

LOG OF TRENCH RV-T-7
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-5-7

FUGRO NATIONAL, INC.

15 JUN 80

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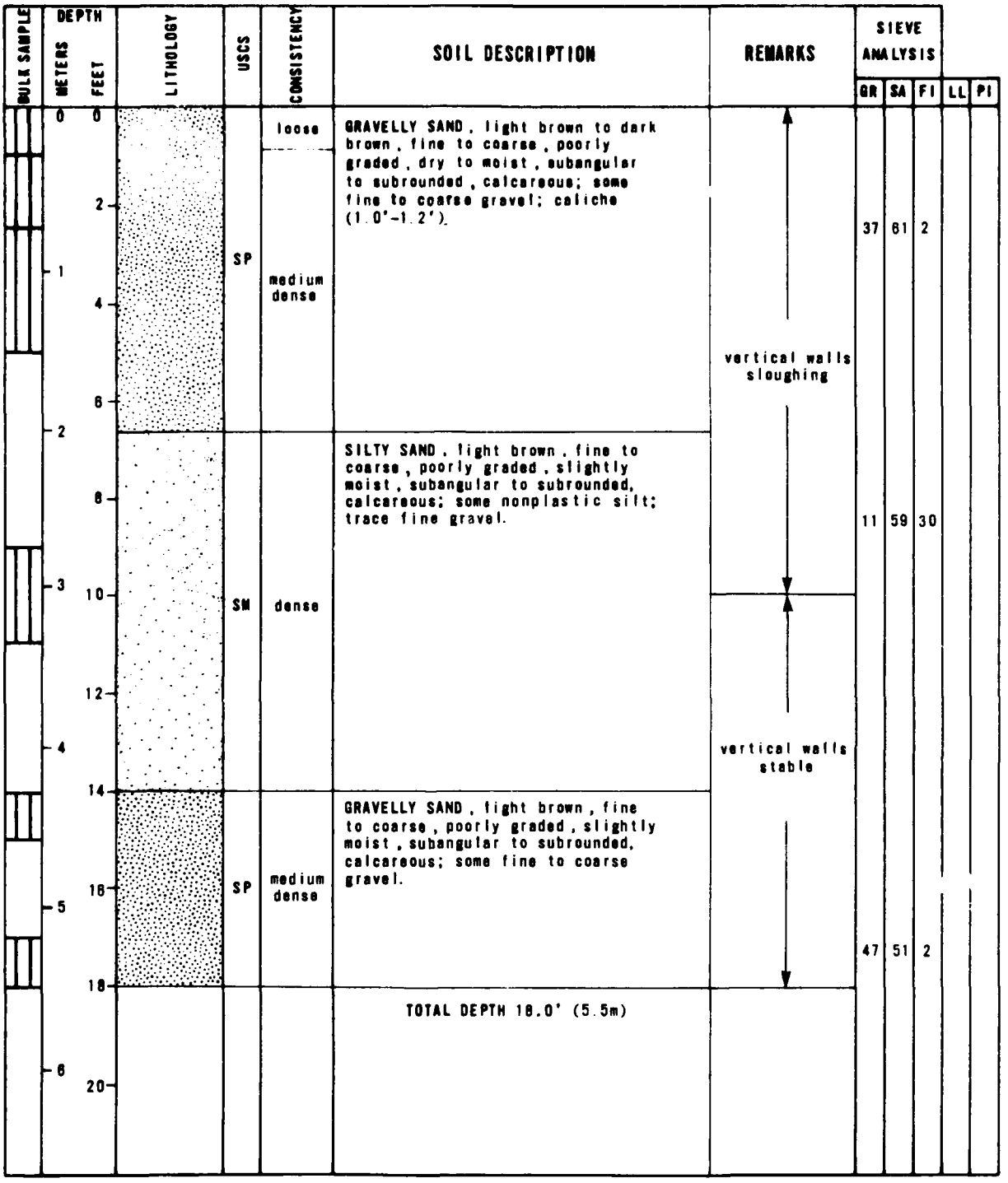
FN-TR-27-RV



TRENCH DETAILS

SURFACE ELEVATION : 5380' (1640m)
DATE EXCAVATED : 20 August 1977
SURFICIAL GEOLOGIC UNIT : A5y
TRENCH LENGTH : 74.0'(23.0m)
TRENCH ORIENTATION : N-S

LOG OF TRENCH RV-T-8
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-5-8

WOODWARD-CLYDE CONSULTANTS

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CHECKED BY

15 JUN 80

AFV-04

SECTION 6.0

LABORATORY TEST RESULTS

6.0 EXPLANATIONS OF LABORATORY TEST RESULTS

Laboratory test results are presented in this section. Table II-6-1 contains a summary of laboratory test results. This table contains results of sieve analysis; plasticity data; in-situ dry unit weight, moisture content, degree of saturation, and void ratio for drive and Pitcher samples; results of compaction tests; and specific gravity of solids. Other tests such as triaxial compression, unconfined compression, direct shear, consolidation, chemical, and California Bearing Ratio (CBR) are indicated on the table. Tables II-6-2 through II-6-4 and Figures II-6-1 through II-6-14 present results of triaxial compression, unconfined compression, direct shear, chemical, and CBR tests.

All tests were performed in general accordance with the American Society for Testing and Materials (ASTM) procedures. The following list presents the ASTM designations for the tests performed during the investigation.

Type of Test	ASTM Designations
Particle Size Analysis	D 422-63
Liquid Limit	D 423-66
Plastic Limit	D 424-59
Unit Weight	D 2937-71
Moisture Content	D 2216-71
Compaction	D 1557-70
Specific Gravity of Solids	D 854-58
Triaxial	D 2850-70
Unconfined Compression	D 2166-66
Direct Shear	D 3080-72
Consolidation	D 2435-70
Test for Alkalinity (pH)	D 1067-70
Water Soluble Sodium	D 1428-64
Water Soluble Chloride	D 512-67
Water Soluble Sulphate	D 516-68
Water Soluble Calcium	D 511-72
Calcium Carbonate	D 1126-67
California Bearing Ratio (CBR)	D 1883-73

Explanation for the tables and figures presented in this section are as follows.

A. Activity Number - Boring or trench sample designation.

B. Sample Number - Prefix indicates the type of sample; explanation is at the bottom of the table.

C. Sample Interval - This is the depth range measured from ground surface over which the sample was obtained.

D. Percent Finer by Weight - Presents the results of laboratory particle size analysis (ASTM D 422-63) performed on representative soil samples at the depth indicated. The numbers represent the percent (by dry weight) of the total sample weight passing through each sieve size indicated.

E. Atterberg Limits (ASTM D 423-66 and D 424-59)

LL - Liquid Limit, the water content (as percent of soil dry weight) corresponding to the arbitrary limit between the liquid and plastic states of consistency of a soil (ASTM D 423-66).

PL - Plastic Limit, the water content corresponding to an arbitrary limit between the plastic and the semisolid state of consistency of a soil (ASTM D 424-59).

PI - Plasticity Index, numerical difference between the liquid limit (LL) and the plastic limit (PL) indicating the range of moisture content within which a soil-water mixture is plastic.

NP - Nonplastic.

F. USCS - Unified Soil Classification Symbols are given here; see Table II-4-1 in Section 4.0, "Boring Logs", for complete details of USCS system.

G. In Situ - Presents results of tests on drive and Pitcher samples.

Dry Unit Weight - indicates dry unit weight of soil determined as per ASTM D 2937-71

Moisture Content - weight of water reported in percent of dry weight of soil sample (ASTM D 2216-71)

Saturation - the degree of saturation in a soil sample is defined as the ratio (in percent) of the volume of water to the volume of all voids in the soil

Void Ratio - the numerical ratio of the volume of voids to the volume of solids in a soil specimen

H. Compacted - Indicates results of laboratory maximum dry density and optimum moisture content test as per ASTM D 1557-70.

I. Specific Gravity of Solids (ASTM D 854-58) - Indicates the ratio of (1) the weight in air of a given volume of soil solids at a stated temperature, to (2) the weight in air of an equal volume of distilled water at a stated temperature.

J. Triaxial - The triaxial compression tests were performed in accordance with the procedures of ASTM D 2850-70. The following explanations and definitions apply.

Triaxial Compression Test - a cylindrical specimen of soil is surrounded by a fluid in a pressure chamber and subjected to an isotropic pressure. An additional compressive load is then applied, directed along the axis of the specimen called the axial load.

Consolidated-Drained (CD) Test - a triaxial compression test in which the soil was first consolidated under an all-around confining stress (test chamber pressure), and was then compressed (and hence sheared) by increasing the vertical stress. "Drained" indicates that excess pore water pressure generated by strains are permitted to dissipate by the free movement of pore water during consolidation and compression.

Consolidated-Undrained (CU) Test - a triaxial compression test in which essentially complete consolidation under the confining (chamber) pressure is followed by a shear test at constant water content.

Confining Pressure (σ_3) - the isotropic chamber pressure applied to the soil specimen during consolidation and compression.

Maximum Deviator Stress (σ_1-σ_3) - the difference between the major and minor principal stresses in the specimen at failure. The major principal stress on the specimen is equal to the unit axial load plus the chamber pressure and the minor principal stress on the specimen is equal to the chamber pressure.

Strain Rate - axial strain, ε , at a given stress level is defined as the ratio of the change in length (L) of the specimen to the original length of the specimen (L_o). The rate of strain was controlled during the test so that this ratio increased at equal increments for each minute of testing.

Back Pressure - pressure in excess of atmospheric applied to the pore water of a soil sample. Back pressure is usually applied to (1) increase saturation of the sample, or (2) simulate the actual in-situ pressure regime.

K. Unconfined Compression - Test procedures were as described in ASTM D 2166-66. Unconfined compressive strength is defined as the load per unit area at which an unconfined prismatic or cylindrical specimen of soil will fail in a simple compression test. In these methods, unconfined compressive strength is taken as the maximum load attained per unit area or the load per unit area at 20 percent axial strain, whichever occurred first during the performance of a test.

L. Direct Shear - The procedures of ASTM D 3080-72 were followed for direct shear testing. In this test, soil under an applied normal load is stressed to failure by moving one section of the soil container (shear box) relative to the

other section. Normal stress is the value of load per unit area acting perpendicular to the plane of shearing. Maximum shear strength is defined as the maximum resistance (ksf) of a soil to shearing (tangential) stresses.

M. Consolidation (ASTM D 2435-70) - A consolidation test is a test in which a cylindrical soil specimen is laterally confined in a ring and compressed between porous plates. The term "consolidation", as used here, indicates the gradual reduction in volume of the soil mass resulting from an increase in compressive stress (axial load per unit area).

N. Chemical - The chemical tests performed on soil samples included: pH; water soluble sodium, chloride, sulphate, calcium; and calcium carbonate content. pH is an index of the acidity or alkalinity of a soil in terms of the logarithm of the reciprocal of the hydrogen ion concentration. ASTM test procedure designations for these chemical tests are included in the list on the first page of these Explanations.

O. CBR - California Bearing Ratio (CBR) is the ratio (in percent) of the resistance to penetration developed by a subgrade soil to that developed by a standard crushed-rock base material. The procedures for conducting a CBR test were as outlined in ASTM D 1883-73. The materials tested for CBR were also analyzed for particle size distribution (ASTM D 422-63) and compaction characteristics (ASTM D 1557-70). The term "percentage of maximum density" indicates the ratio (as a percentage) of the compacted sample

dry unit weight to maximum dry density obtained in the laboratory from ASTM D 1557-70, "Moisture-Density Relations of Soils Using 10-pound (4.5 kg) Hammer and 18-inch (457 mm) Drop."

ACTIVITY NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL		PERCENT FINER BY WEIGH								
				STANDARD SIEVE OPENING							U S ST	
				BLDRS.	COBBLES		GRAVEL					
		FEET	METERS	24"	12"	6"	3"	1½"	3/4"	3/8"	4	10
RV-B-1	D-1	5.5-6.0	1.68-1.83						100	89	81	76
	SS-2	10.0-10.8	3.05-3.29									100
	D-3	15.5-16.0	4.72-4.88						100	87	58	36
	D-4	20.5-21.0	6.25-6.40					100	57	57	51	38
	D-5	25.0-26.0	7.62-7.92					100	94	78	57	36
	D-6	30.2-30.7	9.20-9.36					100	91	69	52	38
	D-7	40.5-40.8	12.34-12.44									
	D-7	40.8-41.0	12.44-12.50									
	D-8	50.5-51.0	15.39-15.54					100	89	74	60	47
	D-9	61.2-61.7	18.65-18.81						100	92	72	54
	D-10	70.3-70.8	21.43-21.58						100	88	74	59
	D-11	80.5-81.0	24.54-24.69									
	D-12	84.0-85.0	25.60-25.91									
	D-13	90.2-91.9	27.49-28.01						100	94	82	68
	D-14	100.2-100.7	30.54-30.69						100	97	85	65
	D-15	128.2-128.7	39.08-39.23					100	97	91	82	70
	D-16	150.0-151.0	45.72-46.02						100	92	78	64
	D-17	175.0-175.5	53.34-53.49									
	D-18	200.3-200.4	61.05-61.08					100	89	69	54	41
	D-19	223.5-224.2	68.12-68.34									
	P-20	247.0-247.8	75.29-75.53						100	98	87	74
	P-20	247.8-249.0	75.53-75.90					100	88	81	71	62
	P-21	270.0-270.7	82.30-82.51							100	97	92
	P-22	298.0-299.2	90.83-91.20						100	75	64	48
RV-B-2	b-1	5.0-6.0	1.52-1.83					100	90	88	84	71
	b-2	13.0-14.0	3.96-4.27					100	94	86	76	58
	b-4	21.0-22.0	6.40-6.71						100	99	90	73
RV-B-3	SS-1	5.0-6.1	1.52-1.86							100	96	92
	SS-2	14.0-14.9	4.27-4.54									

NOTES:

(a) Sample types
- SS - Standard split spoon
- P - Pitcher
- D - Fugro Drive
- B,b - Bulk

(b) NP - Not Plastic

(c) USCS - Unified Soil Classification System

(d) * Indicates that test has been performed and results are included in this report

CHECKED BY _____ APPROVED BY _____

% FINER BY WEIGHT								ATTERBERG LIMITS (b)			USCS (c)	IN-SITU					COMPACTED			SPECIFIC
	U S STANDARD SIEVE NO					PARTICLE SIZE (mm)						DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)	
	SAND				SILT OR CLAY															
3/8"	4	10	40	100	200	.005	.001	LL	PL	PI		(pcf)	(kg/m³)				(pcf)	(kg/m³)		
89	81	76	64	42	36						SM	102.4	1640	8.2	34.2	0.65				
		100	97	68	45	8	4			NP	SM			12.6						2
87	58	36	17	11	9						SP-SM	107.7	1725	8.2	45.7	0.45				2
57	51	38	20	12	9						GP-GM	118.7	1901	5.4	34.8	0.42				
78	57	36		15	13	9	7	36	19	17	SC	109.4	1752	8.8	44.0	0.54				
69	52	38	25	14	10	4	1	32	21	11	GW-GC	118.9	1905	10.7	69.3	0.42				
											SC	119.7	1917	8.5	56.3	0.41				
											SC	120.5	1930	7.8	52.9	0.40				
74	60	47	27	19	16	10	8	32	19	13	SC	118.1	1892	8.5	53.8	0.43				
92	72	54	35	25	16						SC	117.6	1884	8.8	54.9	0.43				
88	74	59	29	13	9	9	4				SW-SM	102.6	1643	14.6	61.4	0.64				
											SW-SM	98.3	1575	6.5	24.6	0.72				
											SM			22.6						
94	82	68	42	26	15	3	1				SM	108.9	1744	13.3	65.6	0.55				
97	85	65	35	27	21						SM	121.4	1945	10.3	71.7	0.39				
91	82	70	49	37	29						SM	110.3	1767	12.7	65.0	0.53				
92	78	64	44	28	20	4	3				SM	114.5	1834	11.9	68.4	0.47				
											SM	112.2	1797	14.4	77.5	0.50				
69	54	41	24	16	13						GM									
											SM	76.5	1225	42.2	94.7	1.20				
98	87	74	46	33	25	2	0			NP	SM	77.0	1233	40.8	96.5	1.09				2
81	71	62	47	34	27	3	1				SM	85.6	1371	28.9	80.6	0.97				
100	97	92	65	40	27						SM	76.2	1221	44.4	99.0	1.21				
75	64	48	24	15	12	5	2	62	46	17	SM	116.6	1868	20.6	64.6	0.44				
88	84	71	23	8	5						SW-SM									
86	76	58	25	11	6						SW-SM									
99	90	73	42	25	16						SM			1.5						
100	96	92	82	38	13	2	1				SM			2.9						2
											SM			3.4						

2

ERG (b) PI	USCS (c)	IN-SITU DRY UNIT WEIGHT (pcf)	IN-SITU DRY UNIT WEIGHT (kg/m^3)	IN-SITU MOISTURE CONTENT (%)	IN-SITU SATURATION (%)	IN-SITU VOID RATIO	COMPACTED MAXIMUM DRY DENSITY (pcf)	COMPACTED MAXIMUM DRY DENSITY (kg/m^3)	COMPACTED OPTIMUM MOISTURE (%)	SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	CBR
	SM	102.4	1640	8.2	34.2	0.65										
NP	SM			12.6						2.59						
	SP-SM	107.7	1725	8.2	45.7	0.45				2.50	*					
	GP-GM	118.7	1901	5.4	34.8	0.42					*					
17	SC	109.4	1752	8.8	44.0	0.54					*					
11	GW-GC	118.9	1905	10.7	69.3	0.42										
	SC	119.7	1917	8.5	56.3	0.41										
	SC	120.5	1930	7.8	52.9	0.40										
13	SC	118.1	1892	8.5	53.8	0.43					*					
	SC	117.6	1884	8.8	54.9	0.43					*					
	SW-SM	102.6	1643	14.6	61.4	0.64					*					
	SW-SM	98.3	1575	6.5	24.6	0.72										
	SM			22.6												
	SM	108.9	1744	13.3	65.6	0.55					*					
	SM	121.4	1945	10.3	71.7	0.39					*					
	SM	110.3	1767	12.7	65.0	0.53					*					
	SM	114.5	1834	11.9	68.4	0.47										
	SM	112.2	1797	14.4	77.5	0.50										
	GM															
	SM	76.5	1225	42.2	94.7	1.20										
NP	SM	77.0	1233	40.8	96.5	1.09				2.58		*				
	SM	85.6	1371	28.9	80.6	0.97										
	SM	76.2	1221	44.4	99.0	1.21										
17	SM	116.6	1868	10.6	64.6	0.44										
	SW-SM															
	SW-SM															
	SM			1.5												
	SM			2.9						2.54						*
	SM			3.4												

SUMMARY OF LABORATORY TEST RESULTS
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

TABLE II-6-1 1 OF 7

FUGRO NATIONAL, INC.

AFV-01

ACTIVITY NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL		PERCENT FINER BY WEIGHT								
				STANDARD SIEVE OPENING							U S STAN	
				BLDRS.	COBBLES		GRAVEL				SA	
		FEET	METERS	24"	12"	6"	3"	1½"	3/4"	3/8"	4	10
RV-B-4	b-1	5.0-6.0	1.52-1.83					100	54	28	17	12
	b-2	13.0-14.0	3.96-4.27									
	b-3	21.0-22.0	6.40-6.71					100	67	45	31	20
	b-4	29.0-30.0	8.84-9.14									
	b-6	55.0-56.0	16.76-17.07					100	72	39	26	15
RV-B-5	b-1	0.0-3.0	0.00-0.9[illegible]					100	96	85	73	62
	SS-2	5.5-6.5	1.68-1.98							100	92	82
	SS-4	10.5-11.5	3.20-3.51									100
	P-3	15.0-15.8	4.57-4.82							100	98	89
	P-3	15.8-16.1	4.82-4.91									
	P-4	20.0-20.8	6.10-6.34						100	96	87	71
	P-4	20.8-21.1	6.34-6.43									
	P-5	25.0-25.8	7.62-7.86							100	95	90
	P-5	25.8-26.1	7.86-7.96									
	P-6	30.0-31.4	9.14-9.57									
	P-7	40.0-40.8	12.19-12.44						100	95	82	71
	P-8	50.0-50.8	15.24-15.48									
	P-9	60.0-60.8	18.29-18.53							100	99	96
	P-10	70.0-71.4	21.34-21.76									
	P-11	80.0-80.7	24.38-24.60									100
	P-12	100.0-100.7	30.48-30.69									
RV-B-6	b-1	0.5-1.0	0.15-0.30									100
	P-1	5.0-5.7	1.52-1.74									100
	P-2	10.0-10.7	3.05-3.26									
	P-3	15.7-16.3	4.79-4.97									100
	P-4	20.0-20.7	6.10-6.31						100	91	82	69
	P-4	20.7-22.0	6.31-6.71									
	P-5	25.0-25.7	7.62-7.83							100	98	94
	P-6	30.0-30.8	9.14-9.39								100	99
	P-7	40.0-40.8	12.19-12.44									
	P-8	50.1-50.9	15.27-15.51									100
	P-9	60.1-60.9	18.32-18.56									100
	P-10	70.1-70.8	21.37-21.58							100	99	98
	P-12	80.1-80.8	24.41-24.63							100	98	94
	P-13	90.1-90.8	27.46-27.68								100	97
	P-14	100.1-100.8	30.51-30.72							100	98	91
	P-15	121.0-121.7	36.88-37.09						100	97	85	72
	P-16	149.1-149.8	45.45-45.66									
	P-17	176.1-176.9	53.68-53.92									
	P-17	176.1-176.9	53.68-53.92									
	P-17	178.0-178.6	54.25-54.44									

NOTES:

(a) Sample types
- SS - Standard split spoon
- P - Pitcher
- D - Fugro Drive
- B,b - Bulk

(b) NP - Not Plastic

(c) USCS - Unified Soil Classification System

(d) * Indicates that test has been performed and results are included in this report

CENT FINER BY WEIGHT									ATTERBERG LIMITS (b)			USCS (c)	IN-SITU					COMPACTED		
		U S STANDARD SIEVE NO					PARTICLE SIZE (mm)						DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)
		SAND				SILT OR CLAY														
4"	3 8"	4	10	40	100	200	.005	.001	LL	PL	PI		(pcf)	(kg/m^3)				(pcf)	(kg/m^3)	
4	28	17	12	6	2	1						GP			0.5					
												GP			1.0					
7	45	31	20	8	5	4						GW			1.1					
												GW			3.0					
2	39	26	15	7	5	4						GW			1.4					
6	85	73	62	49	29	18	8	2				SM			5.2					
	100	92	82	67	48	28	7	4			NP	SM								
			100	94	31	25						SM			2.2					
	100	98	89	67	41	22	8	4				SM	110.6	1772	13.1	67.6	0.52			
												SM								
0	96	87	71	34	11	6						SP-SM	100.8	1615	9.1	36.6	0.67			
												SP-SM								
	100	95	90	72	38	20						SM	101.1	1619	7.7	31.2	0.67			
												SM								
												SM	105.1	1684	17.8	79.7	0.60			
0	95	82	71	41	13	10						SW-SM	108.7	1741	12.4	60.9	0.55			
												SP-SM	96.0	1538	13.5	48.3	0.76			
	100	99	96	80	30	12						SP-SM	104.1	1668	10.2	44.5	0.62			
												SP-SM	99.4	1592	14.6	56.7	0.69			
			100	99	88	78	10	2				ML	96.3	1543	12.1	43.6	0.75			
												SM	91.6	1467	22.6	73.5	0.84			
			100	97	84	63	15	10			NP	ML								
			100	91	61	37	9	4				SM	87.0	1394	8.4	24.2	0.93			
												SM	103.0	1650	6.5	27.6	0.64			
			100	97	68	30						SM	97.4	1560	5.7	21.0	0.73			
0	91	82	69	29	7	4	2	1				SP	81.2	1301	23.3	58.5	1.07			
									36	25	11	SP	80.9	1296	27.9	69.5	1.08			
	100	98	94	76	54	38						SM	90.5	1450	20.9	65.4	0.86			
		100	99	89	47	18						SM	93.5	1498	11.5	41.1	0.72			
												SM	110.1	1764	13.8	70.3	0.53			
			100	97	85	48	4	1				SM	93.3	1495	12.1	40.5	0.81			
			100	99	89	56	11	7				ML	89.2	1429	15.4	49.1	0.81			
	100	99	98	90	75	43						SM	95.2	1525	8.3	29.1	0.77			
	100	98	94	66	30	13						SM	102.7	1645	16.7	70.0	0.64			
		100	97	82	70	43						SM	106.2	1701	15.8	72.7	0.57			
	100	98	91	67	33	14						SM	105.5	1690	14.4	65.0	0.59			
	97	85	72	56	41	16	5	1				SM	97.6	1563	18.8	70.1	0.73			
												SM	96.6	1547	17.1	62.1	0.74			
									46	23	24	CL	94.4	1512	24.9	85.6	0.78			
												CL	89.3	1430	30.6	93.0	0.89			
						82						CL	82.5	1322	37.3	96.7	1.04			

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ERG S (b)		USCS (c)	IN-SITU					COMPACTED			SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	CBR
			DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)							
L	PI		(pcf)	(kg/m³)				(pcf)	(kg/m³)								
		GP			0.5												
		GP			1.0												
		GW			1.1												
		GW			3.0												
		GW			1.4												
		SM			3.2												
	NP	SM									2.59						
		SM			2.2												
		SM	110.6	1772	13.1	67.6	0.52					*				*	
		SM												*			
		SP-SM	100.8	1615	9.1	36.6	0.67					*					
		SP-SM												*			
		SM	101.1	1619	7.7	31.2	0.67					*					
		SM												*			
		SM	105.1	1684	17.8	79.7	0.60										
		SW-SM	108.7	1741	12.4	60.9	0.55										
		SP-SM	96.0	1538	13.5	48.3	0.76										
		SP-SM	104.1	1668	10.2	44.5	0.62										
		SP-SM	99.4	1592	14.6	56.7	0.69										
		ML	96.3	1543	12.1	43.6	0.75										
		SM	91.6	1467	22.6	73.5	0.84										
	NP	ML									2.58						
		SM	87.0	1394	8.4	24.2	0.93							*			
		SM	103.0	1650	6.5	27.6	0.64							*			
		SM	97.4	1560	5.7	21.0	0.73							*			
		SP	81.2	1301	23.3	58.5	1.07						*			*	
)	11	SP	80.9	1296	27.9	69.5	1.08								*		
		SM	90.5	1450	20.9	65.4	0.86										
		SM	93.5	1498	11.5	41.1	0.72				2.58						
		SM	110.1	1764	13.8	70.3	0.53										
		SM	93.3	1495	12.1	40.5	0.81					*					
		ML	89.2	1429	15.4	49.1	0.81				2.59						
		SM	95.2	1525	8.3	29.1	0.77					*					
		SM	102.7	1645	16.7	70.0	0.64										
		SM	106.2	1701	15.8	72.7	0.57					*					
		SM	105.5	1690	14.4	65.0	0.59										
		SM	97.6	1563	18.8	70.1	0.73										
		SM	96.6	1547	17.1	62.1	0.74										
	24	CL	94.4	1512	24.9	85.6	0.78										
		CL	89.3	1430	30.6	93.0	0.89						*				
		CL	82.5	1322	37.3	96.7	1.04						*				

SUMMARY OF LABORATORY TEST RESULTS
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

TABLE II-6-1
2 OF 7

FUGRO NATIONAL, INC.

AFV-01

ACTIVITY NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL		PERCENT FINER BY WEIGHT									
				STANDARD SIEVE OPENING							U S STANDAR		
				BLDRS	COBBLES		GRAVEL				SAND		
		FEET	METERS	24"	12"	6"	3"	1½"	3/4"	3/8"	4	10	4
RV-B-6	P-18	200.2-201.0	61.02-61.26										
	P-18	200.2-201.0	61.02-61.26										
	P-19	227.5-228.2	69.34-69.56							100	95	81	4
	P-20	250.1-250.9	76.23-76.47									100	9
	P-20	251.9-252.6	76.78-76.99										
	P-21	276.1-276.8	84.16-84.37										
	D-22	299.4-299.9	91.26-91.41										
RV-B-7	P-1	5.0-5.7	1.52-1.74							100	96	90	4
	B-2	10.5-11.5	3.20-3.51										
	SS-3	15.0-16.5	4.57-5.03						100	96	89	77	5
	P-4	20.0-20.8	6.10-6.34										
	P-4	20.0-20.8	6.10-6.34										
	P-5	25.0-25.7	7.62-7.83						100	99	97	89	5
	P-6	30.0-30.8	9.14-9.39									100	9
	P-6	30.0-30.8	9.14-9.39										
	D-7	40.0-41.2	12.19-12.56										
	D-8	50.0-50.7	15.24-15.45					100	95	77	59	43	2
	P-9	58.6-59.6	17.86-18.17										
	P-10	69.0-69.7	21.03-21.24								100	98	8
	P-11	81.0-81.7	24.69-24.90										
	P-12	91.8-93.0	27.98-28.35						100	92	83	67	2
	P-13	98.0-98.7	29.87-30.08									100	9

NOTES:

(a) Sample types
- SS - Standard split spoon
- P - Pitcher
- D - Fugro Drive
- B,b - Bulk

(b) NP - Not Plastic

(c) USCS - Unified Soil Classification System

(d) * Indicates that test has been performed and results are included in this report

CHECKED BY _____ APPROVED BY _____

T FINER BY WEIGHT								ATTERBERG LIMITS (b)			USCS (c)	IN-SITU					COMPACTED			SPECIFIC
	U S STANDARD SIEVE NO					PARTICLE SIZE (mm)						DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)	
	SAND				SILT OR CLAY															
3/8"	4	10	40	100	200	.005	.001	LL	PL	PI		(pcf)	(kg/m³)				(pcf)	(kg/m³)		
								66	37	29	MH	74.4	1192	44.3	98.8	1.15				2.
											MH	75.7	1213	41.5	91.4	1.23				
100	95	81	40	15	7						SP-SM	110.2	1765	16.3	83.8	0.53				
		100	92	70	40	13	7	38	22	16	SC	88.8	1422	28.8	86.8	0.90				
											SC	87.6	1403	32.3	94.5	0.92				
								55	34	22	MH	80.4	1288	36.9	91.0	1.10				
								61	31	30	MH	71.7	1149	46.1	92.3	1.35				
100	96	90	49	15	10						SW-SM	102.1	1635	6.2	25.7	0.65				
											SM			2.2						
96	89	77	57	36	23						SM			29.9						
					64			27	23	5	ML	96.8	1551	20.1	73.3	0.74				
											ML	96.4	1544	20.7	74.7	0.75				
99	97	89	57	33	25					NP	SM	102.8	1647	16.6	70.2	0.64				
		100	93	75	52	21	11			NP	ML	110.0	1762	13.8	82.5	0.42				2.
											ML	107.4	1721	15.5	85.5	0.45				
											SP-SM	103.0	1650	18.8	79.8	0.64				
77	59	43	27	11	9						SP-SM	115.4	1849	7.0	41.1	0.46				
											SP-SM	112.7	1805	16.0	87.3	0.49				
	100	98	87	69	50					NP	ML	98.3	1575	29.8	74.9	0.71				
										NP	ML	83.6	1339	24.2	64.5	1.01				
92	83	67	22	5	3						SP	110.7	1773	14.8	76.6	0.52				
		100	98	92	86	37	15				CL	92.6	1483	20.6	85.9	0.82				

BERG S (b)		USCS (c)	IN-SITU					COMPACTED			SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	CBR
			DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)							
L	PI		(pcf)	(kg/m^3)				(pcf)	(kg m^3)								
7	29	MH	74.4	1192	44.3	98.8	1.15				2.56		*				
		MH	75.7	1213	41.5	91.4	1.23										
		SP-SM	110.2	1765	16.3	83.8	0.53										
2	16	SC	88.8	1422	28.8	86.8	0.90										
		SC	87.6	1403	32.3	94.5	0.92						*				
4	22	MH	80.4	1288	36.9	91.0	1.10						*				
1	30	MH	71.7	1149	46.1	92.3	1.35						*				
		SW-SM	102.1	1635	6.2	25.7	0.65							*			
		SM			2.2												
		SM			19.8												
3	5	ML	96.8	1551	20.1	73.3	0.74						*				
		ML	96.4	1544	20.7	74.7	0.75								*		
	NP	SM	102.8	1647	16.6	70.2	0.64										
	NP	ML	110.0	1762	13.8	82.5	0.42				2.50		*				
		ML	107.4	1721	15.5	85.5	0.45								*		
		SP-SM	103.0	1650	18.8	79.8	0.64										
		SP-SM	115.4	1849	7.0	41.1	0.46										
		SP-SM	112.7	1805	16.0	87.3	0.49										
	NP	ML	98.3	1575	29.8	74.9	0.71										
	NP	ML	83.6	1338	24.2	64.5	1.01						*				
		SP	110.7	1773	14.8	76.6	0.52										
		CL	92.6	1483	20.0	65.9	0.82										

SUMMARY OF LABORATORY TEST RESULTS
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMO

TABLE II-6-1
3 OF 7

FUGRO NATIONAL, INC.

AFV-01

ACTIVITY NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL		PERCENT FINER BY WEI								
				STANDARD SIEVE OPENING							U S S	
				BLDRS.	COBBLES		GRAVEL					
		FEET	METERS	24"	12"	6"	3"	1½"	3/4"	3/8"	4	1
RV-B-8	D-1	5.7-6.2	1.74-1.89					100	91	80	67	51
	D-2	10.7-11.2	3.26-3.41									
	D-3	15.3-15.8	4.66-4.82						100	82	69	55
	D-4	20.4-20.9	6.22-6.37						100	99	89	76
	D-5	25.4-25.9	7.74-7.89						100	96	89	72
	D-6	30.4-30.9	9.27-9.42						100	87	77	66
	D-7	40.0-40.9	12.19-12.47					100	96	85	77	68
	D-8	50.0-50.9	15.24-15.51					100	88	66	53	41
	D-9	60.0-60.9	18.29-18.56									
	D-10	70.0-70.9	21.34-21.61					100	86	69	54	42
	D-11	80.0-80.9	24.38-24.66									
	D-12	90.0-90.9	27.43-27.71									
	D-13	100.0-101.0	30.48-30.78						100	84	63	44
	D-14	125.0-125.9	38.10-38.37							100	99	96
	D-15	150.0-150.9	45.72-45.99									100
	D-16	177.0-178.0	53.95-54.25									
	D-17	200.5-201.2	61.11-61.33									100
	D-18	225.2-225.9	68.64-68.85							100	99	95
	D-19	250.2-250.9	76.20-76.47						100	98	97	93
	D-21	300.2-300.7	91.50-91.65									100
RV-B-9	SS-1	5.0-6.0	1.52-1.83						100	94	85	74
	SS-2	10.0-10.2	3.05-3.11									
	P-3	15.7-16.5	4.79-5.03									
	SS-4	20.0-20.6	6.10-6.28									100
	P-6	30.0-30.5	9.14-9.30						100	99	91	74
	P-8	50.7-51.8	15.45-15.79							100	99	97
	P-10	70.0-70.7	21.34-21.55						100	95	85	73
	SS-12	100.0-100.7	30.48-30.69						100	91	75	63
RV-B-10	b-3	21.0-22.0	6.40-6.71						100	93	81	59
	b-7	72.0-73.0	21.95-22.25									
	b-8	90.0-91.0	27.43-27.74					100	95	88	70	49
	b-9	99.0-100.0	30.18-30.48						100	97	89	81

NOTES:

(a) Sample types
- SS - Standard split spoon
- P - Pitcher
- D - Fugro Drive
- B,b - Bulk

(b) NP - Not Plastic

(c) USCS - Unified Soil Classification System

(d) * Indicates that test has been performed and results are included in this report

CHECKED BY _____ APPROVED BY _____

R BY WEIGHT											IN-SITU					COMPACTED			
U S STANDARD SIEVE NO					PARTICLE SIZE (mm)		ATTERBERG LIMITS (b)			USCS (c)	DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)	SPECIFIC GRAVITY OF SOLIDS
SAND				SILT OR CLAY															
4	10	40	100	200	.005	.001	LL	PL	PI		(pcf)	(kg/m³)				(pcf)	(kg/m³)		
67	51	22	9	8						SP-SM	107.5	1722	3.8	18.1	0.57				
										SP-SM	100.4	1608	12.6	50.2	0.68				
69	55	30	15	12						SW-SM	115.8	1855	7.8	46.3	0.45				
89	76	43	22	18						SC	116.9	1873	7.4	53.4	0.35				2.53
89	72	30	17	15	8	6	35	15	20	SC	114.6	1837	8.9	59.6	0.38				
77	66	41	20	15	5	2	34	21	13	SC	114.7	1837	8.9	59.7	0.38				
77	68	52	24	18						SC	113.6	1820	10.2	57.0	0.48				
53	41	20	9	7	2	1				GW-GM	121.4	1945	9.4	65.4	0.39				
										SW-SM	113.0	1810	13.3	73.1	0.49				
54	42	19	9	7	2	1				SW-SM	114.5	1834	8.2	47.0	0.47				
										SW-SM	116.3	1863	8.3	49.9	0.45				
										SW-SM	113.9	1825	9.6	54.1	0.48				
63	44	22	12	9						SW-SM	115.5	1850	9.5	55.9	0.46				
99	96	85	40	20						SM	107.0	1714	8.4	39.5	0.57				
	100	93	76	55	12	4	26	22	4	ML	107.2	1717	9.6	45.3	0.57				
										SP	117.8	1887	7.6	47.7	0.43				
	100	97	79	63						ML									
99	95	75	46	22	8	3				SM	114.6	1836	10.6	60.9	0.47				
97	93	82	66	45	10	4			NP	SM	114.2	1829	12.0	68.2	0.48				
	100	65	35	28	8	3				SM	115.1	1844	10.0	58.2	0.46				
85	74	55	35	23	4	0				SM									
										SM									
				7			25	16	9	SP-SC	101.0	1618	17.8	71.9	0.67				
	100	99	94	87						CL									
91	74	40	16	8	3	1				SP-SM	103.6	1660	11.5	49.5	0.63				
99	97	88	64	53	17	9				CL	92.3	1479	22.3	73.0	0.83				
85	73	47	11	6	1	0				SP-SM	106.5	1706	20.6	95.6	0.58				
75	63	25	9	6						SP-SM									
81	59	35	21	12	3	2				SM			1.7						
										SC			8.0						
70	49	21	10	6						SP-SM			1.3						
89	81	55	29	17	2	1				SM			1.6						

ATTERBERG LIMITS (b)		USCS (c)	IN-SITU					COMPACTED			SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	CBR
			DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)							
PL	PI		(pcf)	(kg/m^3)				(pcf)	(kg/m^3)								
		SP-SM	107.5	1722	3.8	18.1	0.57										
		SP-SM	100.4	1608	12.6	50.2	0.68					*					
		SW-SM	115.8	1855	7.8	46.3	0.45					*					
		SC	116.9	1873	7.4	53.4	0.35				2.53	*					
15	20	SC	114.6	1837	8.9	59.6	0.38								*		
21	13	SC	114.7	1837	8.9	59.7	0.38								*		
		SC	113.6	1820	10.2	57.0	0.48										
		GW-GM	121.4	1945	9.4	65.4	0.39										
		SW-SM	113.0	1810	13.3	73.1	0.49										
		SW-SM	114.5	1834	8.2	47.0	0.47										
		SW-SM	116.3	1863	8.3	49.9	0.45										
		SW-SM	113.9	1825	9.6	54.1	0.48										
		SW-SM	115.5	1850	9.5	55.9	0.46										
		SM	107.0	1714	8.4	39.5	0.57										
22	4	ML	107.2	1717	9.6	45.3	0.57										
		SP	117.8	1887	7.6	47.7	0.43										
		ML															
		SM	114.6	1836	10.6	60.9	0.47										
	NP	SM	114.2	1829	12.0	68.2	0.48						*				
		SM	115.1	1844	10.0	58.2	0.46										
		SM															
		SM														*	
16	9	SP-SC	101.0	1618	17.8	71.9	0.67										
		CL															
		SP-SM	103.6	1660	11.5	49.5	0.63								*		
		CL	92.3	1479	22.3	73.0	0.83										
		SP-SM	106.5	1706	20.6	95.6	0.58										
		SP-SM															
		SM			1.7												
		SC			8.0												
		SP-SM			1.3												
		SM			1.6												

SUMMARY OF LABORATORY TEST RESULTS
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMO

TABLE II-6-1
4 OF 7

FUGRO NATIONAL, INC.

AFV-01

ACTIVITY NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL		PERCENT FINER BY WEIGHT								
				STANDARD SIEVE OPENING							U S STAND	
				BLDRS.	COBBLES		GRAVEL				SAND	
		FEET	METERS	24"	12"	6"	3"	1½"	3/4"	3/8"	4	10
RV-B-12	B-1	0.0-2.2	0.00-0.67					100	91	78	65	55
	D-1	5.0-6.4	1.52-1.95						100	94	79	62
	D-2	10.2-10.9	3.11-3.32					100	67	52	39	28
	D-3	15.4-15.9	4.64-4.85						100	90	78	60
	D-4	20.3-20.8	6.19-6.34						100	91	79	63
	P-6	30.0-30.7	9.14-9.36							100	99	98
	P-7	38.0-38.7	11.58-11.80									
	P-8	48.0-48.7	14.63-14.84							100	95	90
	P-9	58.0-58.8	17.68-17.92									
	P-10	68.0-68.7	20.73-20.94								100	99
	P-11	80.0-80.7	24.38-24.60									
	P-12	90.0-90.9	27.43-27.71							100	99	95
RV-B-13	SS-1	5.0-6.4	1.52-1.95						100	73	55	37
	SS-5	25.0-25.7	7.62-7.83						100	99	96	91
	D-6	30.0-30.5	9.14-9.30					100	90	68	53	37
	B-7	40.0-41.9	12.19-12.77					100	86	70	54	41
	P-8	50.0-50.8	15.24-15.48									100
	D-9	60.0-60.7	18.29-18.50							100	96	65
	D-10	70.0-70.9	21.34-21.61				100	72	61	50	40	28
	D-11	80.0-81.0	24.38-24.69					100	93	83	65	46
	D-12	90.0-91.0	27.43-27.74									
	D-13	100.0-100.7	30.48-30.69					100	89	82	69	53
	D-14	125.0-125.8	38.10-38.34						100	80	64	46
	D-15	150.0-150.5	45.72-45.87						100	79	67	49
	D-16	181.0-181.9	55.17-55.44					100	91	72	54	38
	D-17	200.0-200.7	60.96-61.17					100	91	71	53	42
	D-18	250.0-251.0	76.20-76.50									
	D-19	275.0-276.0	83.82-84.12					100	88	85	64	53
	D-20	301.0-301.7	91.74-91.96						100	96	77	50

NOTES:

(a) Sample types
- SS - Standard split spoon
- P - Pitcher
- D - Fugro Drive
- B,b - Bulk

(b) NP - Not Plastic

(c) USCS - Unified Soil Classification System

(d) * Indicates that test has been performed and results are included in this report

CHECKED BY _____ APPROVED BY _____

S STANDARD SIEVE NO				PARTICLE SIZE (mm)		ATTERBERG LIMITS (b)			USCS (c)	DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)
SAND				SILT OR CLAY									
10	40	100	200	.005	.001	LL	PL	PI		(pcf)	(kg/m^3)		
55	42	28	19	6	3				SM				
62	47	38	33	20	5				SM	106.2	1701	10.0	46.0
28	18	14	12						GP-GM	112.1	1796	11.6	62.3
60	33	18	11						SW-SM	116.4	1865	5.4	32.6
63	33	20	15	7	6				SM	111.5	1786	9.7	51.2
98	85	57	28						SM	84.3	1350	21.3	57.6
									SM	88.1	1411	14.6	43.2
90	76	43	22						SM	90.1	1443	15.1	49.0
									SM	91.1	1459	19.7	62.5
99	80	49	22						SM	81.5	1306	16.7	42.2
									SM	86.3	1382	16.8	47.6
95	80	36	13						SM	92.4	1480	22.4	73.5
37	15	9	7						SW-SM				
91	86	76	66						ML			15.2	
37	16	11	9						GP-GM	108.3	1735	15.7	76.3
41	21	12	11						GP-GM	119.1	1908	9.2	59.9
100	99	91	70	7	2			NP	ML	85.2	1365	19.6	56.8
65	19	15	14	12	12				SC	115.4	1849	11.7	68.7
28	15	10	9						GW-GC	122.1	1956	9.0	64.0
46	21	16	13						SC	115.5	1850	11.7	68.9
									SC	118.2	1893	9.6	60.9
53	24	15	13	9	8				SC	122.5	1962	9.3	66.9
46	27	20	17						SC	114.8	1839	14.9	86.0
49	27	18	13						SC	117.3	1879	12.3	76.1
38	23	15	12	6	4				GP-GC	122.9	1969	10.3	75.0
42	22	11	8						GP-GC	120.9	1937	11.2	76.8
									GP-GC	116.6	1868	11.8	71.6
53	43	27	17						SM	109.6	1756	17.1	85.9
50	21	11	7	2	2			NP	SW-SM	107.8	1727	14.5	69.6

ERG S (b)		USCS (c)	IN-SITU					COMPACTED			SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	CBR
			DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)							
L	PI		(pcf)	(kg/m³)				(pcf)	(kg/m³)								
		SM															
		SM	106.2	1701	10.0	46.0	0.59										
		GP-GM	112.1	1796	11.6	62.3	0.50					*					
		SW-SM	116.4	1865	5.4	32.6	0.45					*					
		SM	111.5	1786	9.7	51.2	0.51					*					
		SM	84.3	1350	21.3	57.6	1.00							*	*		
		SM	88.1	1411	14.6	43.2	0.91										
		SM	90.1	1443	15.1	49.0	0.80				2.60			*			
		SM	91.1	1459	19.7	62.5	0.85										
		SM	81.5	1306	16.7	42.2	1.07										
		SM	86.3	1382	16.8	47.6	0.95										
		SM	92.4	1480	22.4	73.5	0.82										
		SW-SM															
		ML			15.2												
		GP-GM	108.3	1735	15.7	76.3	0.56										
		GP-GM	119.1	1908	9.2	59.9	0.41										
	NP	ML	85.2	1365	19.6	56.8	0.89				2.58			*			
		SC	115.4	1849	11.7	68.7	0.46										
		GW-GC	122.1	1956	9.0	64.0	0.38										
		SC	115.5	1850	11.7	68.9	0.46										
		SC	118.2	1893	9.6	60.9	0.43										
		SC	122.5	1962	9.3	66.9	0.38										
		SC	114.8	1839	14.9	86.0	0.47										
		SC	117.3	1879	12.3	76.1	0.44										
		GP-GC	122.9	1969	10.3	75.0	0.37										
		GP-GC	120.9	1937	11.2	76.8	0.39										
		GP-GC	116.6	1868	11.8	71.6	0.44										
		SM	109.6	1756	17.1	85.9	0.54										
	NP	SW-SM	107.8	1727	14.5	69.6	0.56										

SUMMARY OF LABORATORY TEST RESULTS
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

TABLE II-6-1
5 OF 7

FUGRO NATIONAL, INC.

AFV-01

2 1 3

ACTIVITY NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL		PERCENT FINER BY WEIGHT									
				STANDARD SIEVE OPENING							U S STANDARD		
				BLDRS.	COBBLES		GRAVEL				SAND		
		FEET	METERS	24"	12"	6"	3"	1½"	3/4"	3/8"	4	10	40
RV-B-14	b-1	5.0-6.0	1.52-1.83					100	97	81	62	43	20
	b-2	13.0-14.0	3.96-4.27						100	68	35	20	10
	b-3	21.0-22.0	6.40-6.71										
	b-4	29.0-30.0	8.84-9.14										
	b-6	53.0-54.0	16.15-16.46					100	76	49	39	32	23
	b-7	69.0-70.0	21.03-21.34						100	95	85	77	67
RV-B-15	SS-1	6.0-7.5	1.83-2.29					100	84	78	70	58	40
	SS-2	14.0-15.0	4.27-4.57					100	86	73	56	41	24
	b-3	22.0-23.0	6.71-7.01					100	86	76	65	52	32
	SS-4	31.0-32.0	9.45-9.75										
	SS-5	40.0-41.5	12.19-12.65						100	84	68	51	32
	SS-6	56.0-57.5	17.07-17.53										
RV-B-16	b-1	5.0-6.0	1.52-1.83					100	69	43	29	19	6
	b-2	14.0-15.0	4.27-4.57										
	b-3	22.0-23.0	6.71-7.01										
	b-4	30.0-31.0	9.14-9.45					100	81	55	38	25	11
	b-5	38.0-39.0	11.58-11.89										
	SS-6	47.0-47.5	14.33-14.48						100	96	83	68	44
	SS-7	64.0-65.5	19.51-19.96						100	96	93	89	74
	b-8	89.0-90.0	27.13-27.43							100	99	99	88
	b-9	99.0-100.0	30.18-30.48										

NOTES:

(a) Sample types
- SS - Standard split spoon
- P - Pitcher
- D - Fugro Drive
- B,b - Bulk

(b) NP - Not Plastic

(c) USCS - Unified Soil Classification System

(d) * Indicates that test has been performed and results are included in this report

ER BY WEIGHT											IN-SITU					COMPACTED			
U S STANDARD SIEVE NO.					PARTICLE SIZE (mm)		ATTERBERG LIMITS (b)			USCS (c)	DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)	SPECIFIC GRAVITY OF SOLIDS
SAND				SILT OR CLAY															
4	10	40	100	200	.005	.001	LL	PL	PI		(pcf)	(kg/m^3)				(pcf)	(kg/m^3)		
62	43	20	13	9	2	1				SW-SM			3.6						
35	20	10	7	5	2	1				GP-GM			1.6						
										GP-GM			1.7						
										GP-GM			1.7						
39	32	23	18	15	4	3				GC			3.0						
85	77	67	59	54	28	0				CL			9.2						2.53
70	58	40	30	22						SM			6.5						
56	41	24	15	11	3	1				SW-SM			1.3						
65	52	32	22	18						SM			1.5						
										SM			1.8						
68	51	32	21	13	4	2				SM			1.4						
										SM			2.5						
29	19	6	3	2						GW			0.5						
										GW			0.9						
										GW			1.3						
38	25	11	5	3						GW			0.9						
										GW			1.0						
83	68	44	27	21	10	5				SM			2.8						
93	89	74	41	20	5	2				SM			8.8						
99	99	88	49	27						SM			4.6						
													9.2						

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ATTERBERG LIMITS (b)			USCS (c)	IN-SITU					COMPACTED			SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	CBR
				DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)							
L	PL	PI		(pcf)	(kg/m^3)				(pcf)	(kg/m^3)								
			SW-SM			3.6												
			GP-GM			1.6												
			GP-GM			1.7												
			GP-GM			1.7												
			GC			3.0												
			CL			9.2						2.53						
			SM			6.5												
			SW-SM			1.3											*	
			SM			1.5												
			SM			1.8												
			SM			1.4												
			SM			2.5												
			GW			0.5												
			GW			0.9												
			GW			1.3												
			GW			0.9												
			GW			1.0												
			SM			2.8												
			SM			8.8												
			SM			4.6												
						9.2												

SUMMARY OF LABORATORY TEST RESULTS
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

TABLE II-6-1
6 OF 7

FUGRO NATIONAL, INC.

AFV-01

ACTIVITY NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL		PERCENT FINER BY WEIGHT									
				STANDARD SIEVE OPENING							U S STANDA		
				BLDRS.	COBBLES		GRAVEL				SAND		
		FEET	METERS	24"	12"	6"	3"	1½"	3/4"	3/8"	4	10	
RV-T-1	B-1	0.0-1.5	0.00-0.46									100	
	B-2	5.0-6.5	1.52-1.98										
	B-3	11.5-13.0	3.51-3.96							100	99	95	
	B-4	14.5-16.0	4.42-4.88							100	98	92	
	B-5	17.0-18.0	5.18-5.49								100	98	
RV-T-2	B-1	0.0-0.5	0.00-0.46							100	99	97	
	B-2	2.0-3.0	0.61-0.91							100	99	91	
	B-3	4.5-5.5	1.37-1.68										
	B-4	7.0-8.0	2.13-2.44										
	B-5	10.5-11.5	3.20-3.51										
	B-6	13.5-14.5	4.11-4.42								100	99	
	B-7	16.5-18.0	5.03-5.49							100	98	92	
RV-T-3	B-2	2.5-4.5	0.76-1.37					100	98	82	66	50	
	B-4	13.5-15.0	4.11-4.57										
	B-5	17.0-18.0	5.18-5.49					100	91	97	59	41	
RV-T-4	B-1	0.0-1.0	0.00-0.30										
	B-2	2.5-5.0	0.76-1.52					100	98	80	64	47	
	B-4	11.5-13.0	3.51-3.96						100	95	87	73	
RV-T-5	B-1	0.0-1.0	0.00-0.30										
	B-2	5.0-6.0	1.52-1.83					100	94	79	62	46	
	B-3	11.0-12.5	3.35-3.81										
	B-4	14.5-15.5	4.42-4.72					100	95	87	70	50	
RV-T-6	B-2	1.5-3.5	0.46-1.07					100	77	64	52	37	
	B-3	10.0-13.5	3.05-4.11					100	91	70	55	40	
	B-4	17.0-18.0	5.18-5.49										
RV-T-7	B-1	0.0-0.5	0.00-0.15										
	B-2	4.5-6.0	1.37-1.83										
	B-3	10.0-11.5	3.05-3.51					100	98	88	71	49	
	B-5	17.0-18.0	5.18-5.49					100	98	87	72	53	
RV-T-8	B-3	2.5-5.0	0.76-1.52					100	93	77	63	49	
	B-4	9.0-10.5	2.74-3.20					100	97	93	89	84	
	B-6	17.0-18.0	5.18-5.49					100	76	63	53	41	

NOTES:

(a) Sample types
- SS - Standard split spoon
- P - Pitcher
- D - Fugro Drive
- B,b - Bulk

(b) NP - Not Plastic

(c) USCS - Unified Soil Classification System

(d) * Indicates that test has been performed and results are included in this report

CHECKED BY _____ APPROVED BY _____

MER BY WEIGHT								ATTERBERG LIMITS (b)			USCS (c)	IN-SITU					COMPACTED			SPECIFIC GRAVITY OF SOLIDS
	U S STANDARD SIEVE NO					PARTICLE SIZE (mm)						DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)	
	SAND				SILT OR CLAY							(pcf)	(kg/m^3)				(pcf)	(kg/m^3)		
	4	10	40	100	200	.005	.001	LL	PL	PI										
		100	96	83	59	12	8				ML			8.3						
											ML									
	99	95	79	58	38	11	8			NP	SM			5.0						2.53
	98	92	71	37	28	16	10				SM			7.6						
	100	98	91	45	25	9	7				SM			5.3						
	99	97	84	67	60	29	8	21	18	3	ML			8.9			112.0	1794	15.0	
	99	91	61	39	26	16	8			NP	SM			5.1						2.58
											SM			5.7						
											SM			6.2						
											SM			2.3						
	100	99	97	55	16						SM			3.1			95.3	1527	10.3	
	98	92	72	41	22						SM			7.9						
	66	50	19	5	3						SP			2.1						
											SW-SM			1.9						
	59	41	16	8	6						SW-SM									
								19	16	3	ML			9.8						
	64	47	18	5	4						SP			4.2						
	87	73	36	10	7						SP-SM			3.0						
											SP-SM			6.6						
	62	46	25	13	7	3	2				SP-SM			4.2			118.0	1890	11.5	
											SW-SM									
	70	50	23	13	9	4	2				SW-SM			5.0						
	52	37	12	4	3						SP			1.1			124.5	1994	7.0	
	55	40	18	8	6						SP-SM			3.0						
											SP-SM			5.2						
								19	18	1	ML			10.9						
											ML			4.9						
	71	49	23	13	8						SW-SM			4.2						
	72	53	30	19	13						SM			3.6						
	63	49	17	3	2						SP			1.5						
	89	84	74	52	30	8	3				SM			5.5						
	53	41	15	4	2						SP			1.0						

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ATTERBERG LIMITS (b)		USCS (c)	IN-SITU					COMPACTED			SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	CBR
			DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)							
PL	PI		(pcf)	(kg/m^3)				(pcf)	(kg/m^3)								
		ML			8.3												
		ML														*	
	NP	SM			5.0						2.53						
		SM			7.6												
		SM			5.3												
18	3	ML			8.9			112.0	1794	15.0						*	
	NP	SM			5.1						2.58						*
		SM			5.7												
		SM			6.2												
		SM			2.3												
		SM			3.1			95.3	1527	10.3							
		SM			7.9												*
		SP			2.1											*	*
		SW-SM			1.9												
		SW-SM															
16	3	ML			9.8												
		SP			4.2												*
		SP-SM			3.0												
		SP-SM			6.6												
		SP-SM			4.2			118.0	1890	11.5						*	
		SW-SM															
		SW-SM			5.0												*
		SP			1.1			124.5	1994	7.0							
		SP-SM			3.0												
		SP-SM			5.2												
18	1	ML			10.9												
		ML			4.9												
		SW-SM			4.2												*
		SM			3.6												
		SP			1.5												
		SM			5.5												
		SP			1.0												

SUMMARY OF LABORATORY TEST RESULTS
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

TABLE II-6-1 7 OF 7

FUGRO NATIONAL, INC.

AFV-01

15 JUN 80

FN-TR-27-RV

BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	TYPE OF TEST	DRY DENSITY		MOISTURE CONTENT (%)	CONFINING PRESSURE (σ_3)		MAXIMUM DEVIATOR STRESS ($\sigma_1-\sigma_3$)		STRAIN RATE (% min)	BACK PRESSURE	
		FEET	METERS			pcf	kg/m^3		ksf	kN/m^2	ksf	kN/m^2		ksf	kN/m^2
RV-B-1	D-3	15.5-16.0	4.72-4.88	SP-SM	CD	107.7	1725	8.2	1.7	81	14.5	694	.07	0	0
	D-4	20.5-21.0	6.25-6.40	GP-GM	CD	118.7	1901	5.4	4.0	192	25.7	1230	.07	0	0
	D-5	25.0-26.0	7.62-7.92	SC	CD	109.4	1752	8.8	8.9	426	36.5	1747	.07	0	0
	D-8	50.5-51.0	15.39-15.54	SC	CD	118.1	1892	8.5	5.5	263	27.1	1297	.08	0	0
	D-9	61.2-61.7	18.65-18.81	SC	CD	117.6	1884	8.8	12.4	594	64.4	3083	.09	0	0
	D-10	70.3-70.8	21.43-21.58	SW-SM	CD	102.6	1643	14.6	26.9	1288	110.6	5295	.07	0	0
	D-13	90.2-91.9	27.49-28.01	SM	CD	108.9	1744	13.3	9.9	474	45.1	2159	.07	0	0
	D-14	100.2-100.7	30.54-30.69	SM	CD	121.4	1945	10.3	20.2	967	23.5	1125	.07	0	0
	D-15	128.2-128.7	39.08-39.23	SM	CD	110.3	1767	12.7	44.6	2135	161.2	7717	.07	0	0
RV-B-5	P-3	15.0-15.8	4.57-4.82	SM	CD	110.6	1772	13.1	1.7	81	13.1	627	.07	0	0
	P-4	20.0-20.8	6.10-6.34	SP-SM	CD	100.8	1615	9.1	3.9	182	14.5	694	.07	0	0
	P-5	25.0-25.8	7.62-7.86	SM	CD	101.1	1619	7.7	8.6	412	30.0	1436	.07	0	0
RV-B-6	P-8	50.1-50.9	15.27-15.51	SM	CD	93.3	1495	12.1	5.5	263	32.0	1532	.07	0	0
	P-10	70.1-70.8	21.37-21.58	SM	CD	95.2	1525	8.3	12.7	608	54.9	2628	.07	0	0
	P-13	90.1-90.8	27.46-27.68	SM	CD	106.2	1701	15.8	31.0	1484	121.2	5803	.07	0	0
RV-B-8	D-2	10.7-11.2	3.26-3.41	SP-SM	CD	100.4	1608	12.6	1.2	57	7.7	369	.08	0	0
	D-3	15.3-15.8	4.66-4.82	SW-SM	CD	115.8	1855	7.8	3.3	158	18.1	867	.07	0	0
	D-4	20.4-20.9	6.22-6.37	SC	CD	118.9	1873	7.4	8.8	421	45.5	2178	.07	0	0
RV-B-12	D-2	10.2-10.9	3.11-3.32	GP-GM	CD	112.1	1796	11.6	1.2	57	8.7	417	.07	0	0
	D-3	15.4-15.9	4.69-4.85	SW-SM	CD	116.4	1865	5.4	2.9	139	21.5	1029	.07	0	0
	D-4	20.3-20.8	6.19-6.34	SM	CD	111.5	1786	9.7	5.8	278	26.9	1288	.07	0	0

FUGRO NATIONAL, INC.

SUMMARY OF TRIAXIAL COMPRESSION TEST RESULTS
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

TABLE II-6-2

15 JUN 80

FN-TR-27-RV

BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	UNCONFINED COMP. STRENGTH		DRY DENSITY		MOISTURE CONTENT (%)	DEGREE OF SATURATION (%)	HEIGHT DIAMETER
		FEET	METERS		ksf	kN/m²	pcf	kg/m³			
RV-B-1	P-20	247.0-247.8	75.29-75.53	SM	2.8	134	77.0	1234	40.8	96.5	2.0
RV-B-6	P-4	20.0-20.7	6.10-6.31	SP	2.1	101	81.2	1301	23.3	58.5	2.4
	P-17	176.1-176.9	53.66-53.92	CL	5.4	259	89.3	1430	30.6	93.0	2.4
	P-17	178.0-178.6	54.25- 54.44	CL	6.5	311	82.5	1322	37.3	96.7	2.4
	P-18	200.2-201.0	61.02-61.26	MH	5.5	263	74.4	1192	44.3	98.8	2.4
	P-20	251.9-252.6	76.78-76.99	SC	7.9	378	87.6	1403	32.3	94.5	2.4
	P-21	276.1-276.8	84.16-84.37	MH	8.5	407	80.4	1288	36.9	91.0	2.4
	D-22	299.4-299.9	91.26-91.41	MH	4.8	230	71.7	1149	46.1	92.3	2.4
RV-B-7	P-4	20.0-20.8	6.10-6.34	ML	7.0	335	96.8	1551	20.1	73.3	2.4
	P-6	30.0-30.8	9.14-9.39	ML	14.4	689	110.0	1762	13.8	82.5	2.4
	P-11	81.0-81.7	24.69-24.90	ML	2.8	134	83.6	1339	24.2	64.5	2.4
RV-B-8	D-19	250.2-250.9	76.26-76.47	SM	6.1	292	114.2	1829	12.0	68.2	2.4

SUMMARY OF UNCONFINED COMPRESSION TEST RESULTS
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

TABLE II-6-3

FUGRO NATIONAL, INC.

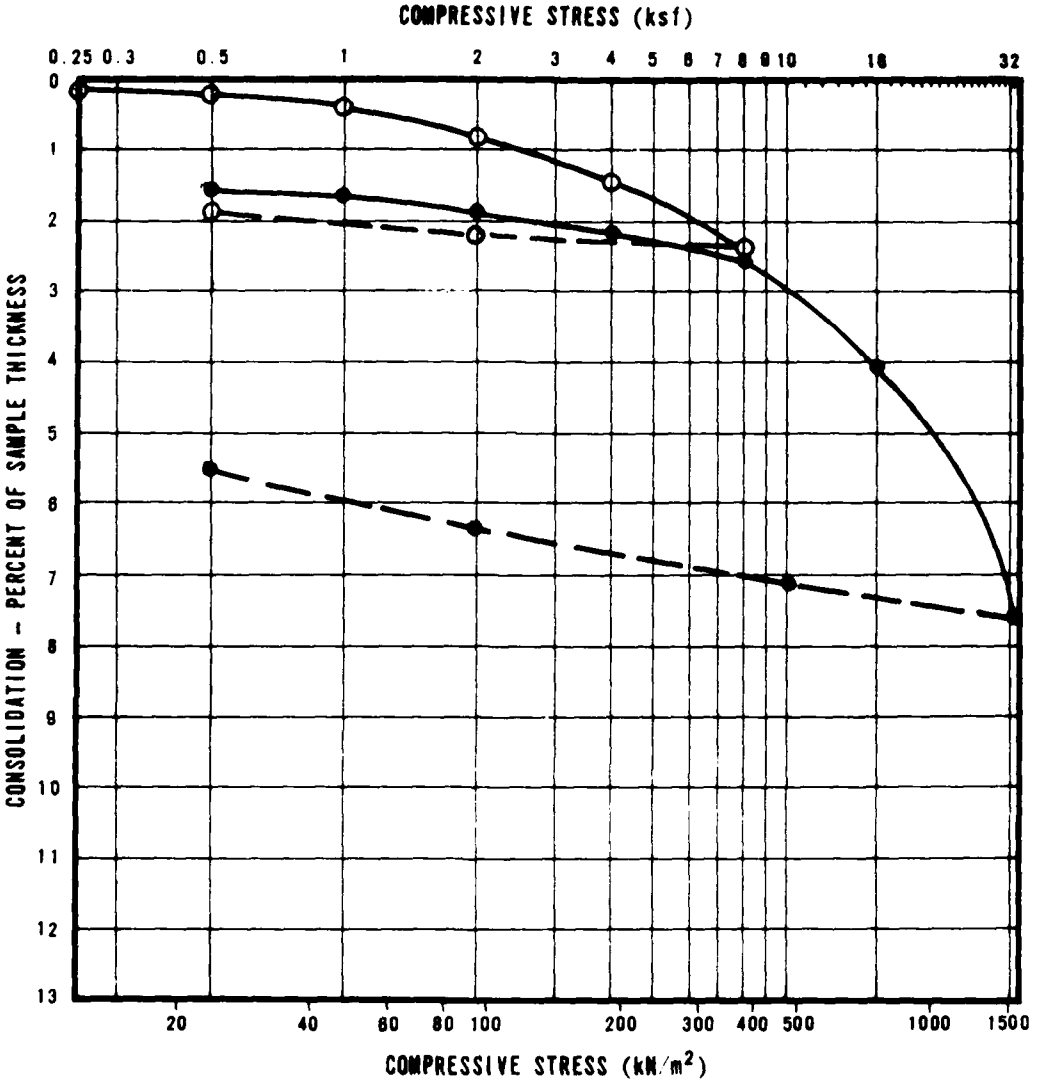
BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	NORMAL STRESS		MAXIMUM SHEAR STRENGTH	
		FEET	METERS		ksf	kN/m^2	ksf	kN/m^2
RV-B-5	P-3	15.8-16.1	4.82-4.91	SM	2.0	96	3.1	149
	P-4	20.8-21.1	6.34-6.43	SP-SM	4.0	192	3.2	153
	P-5	25.8-26.1	7.86-7.96	SM	8.0	383	6.8	326
RV-B-6	P-1	5.0-5.7	1.52-1.74	SM	1.0	48	1.2	57
	P-1	5.0-5.7	1.52-1.74	SM	2.0	96	1.9	91
	P-1	5.0-5.7	1.52-1.74	SM	0.5	24	0.7	34
	P-2	10.0-10.7	3.05-3.26	SM	1.0	48	1.1	53
	P-2	10.0-10.7	3.05-3.26	SM	2.0	96	1.9	91
	P-2	10.0-10.7	3.05-3.26	SM	4.0	192	5.1	244
	P-3	15.7-16.3	4.79-4.97	SM	1.5	72	1.6	77
	P-3	15.7-16.3	4.79-4.97	SM	3.0	144	3.0	144
	P-3	15.7-16.3	4.79-4.97	SM	6.0	287	5.2	249
RV-B-7	P-1	5.0-5.7	1.52-1.74	SW-SM	0.5	24	0.7	34
	P-1	5.0-5.7	1.52-1.74	SW-SM	1.0	48	1.3	62
	P-1	5.0-5.7	1.52-1.74	SW-SM	2.0	96	2.0	96
RV-B-12	P-6	30.0-30.7	9.14-9.36	SM	3.0	144	2.7	129
	P-8	48.0-48.7	14.63-14.84	SM	10.0	479	10.8	517
RV-B-13	P-8	50.0-50.8	15.24-15.48	ML	6.0	287	4.2	201

SUMMARY OF DIRECT SHEAR TEST RESULTS
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

TABLE
II-6-4

FUGRO NATIONAL, INC.



SYMBOL	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	INITIAL DRY DENSITY		INITIAL MOISTURE CONTENT (%)	INITIAL VOID RATIO	INITIAL DEGREE OF SATURATION (%)
			FEET	METERS		pcf	kg/m³			
○	RV-B-6	P-4	20.7-22.0	6.31-6.71	SP	80.9	1296	27.9	1.08	68.5

○ AT FIELD MOISTURE

● AFTER ADDITION OF WATER

——— COMPRESSION

– – – REBOUND

CONSOLIDATION TEST RESULTS
RALSTON VALLEY, NEVADA

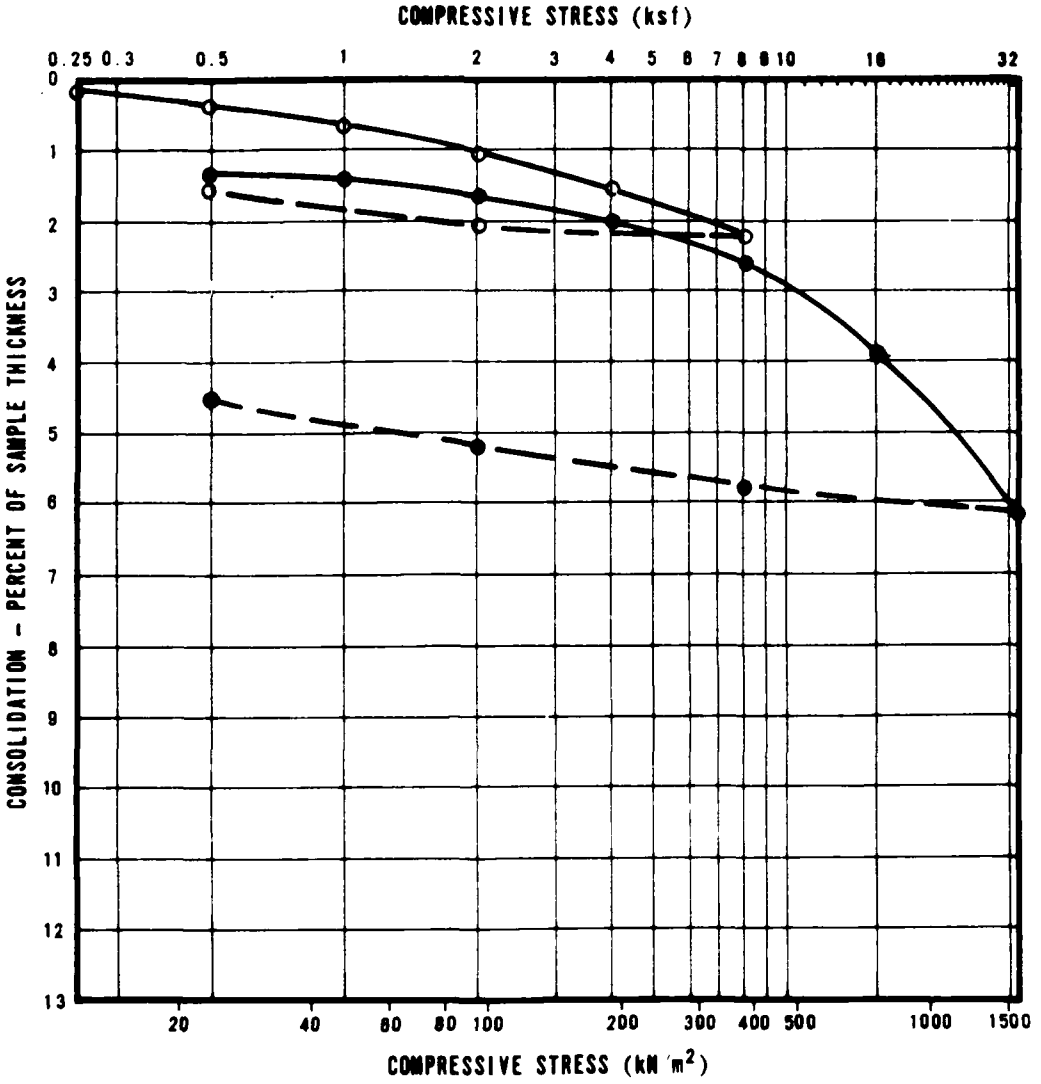
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-6-1

WOODWARD-CLYDE CONSULTANTS

15 JUN 80

AFV-02



SYMBOL	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	INITIAL DRY DENSITY		INITIAL MOISTURE CONTENT (%)	INITIAL VOID RATIO	INITIAL DEGREE OF SATURATION (%)
			FEET	METERS		pcf	kg/m³			
○	RV-B-7	P-4	20.0-20.8	6.10-6.34	ML	96.8	1551	20.1	0.75	74.7

○ AT FIELD MOISTURE

● AFTER ADDITION OF WATER

——— COMPRESSION

– – – REBOUND

CONSOLIDATION TEST RESULTS
RALSTON VALLEY, NEVADA

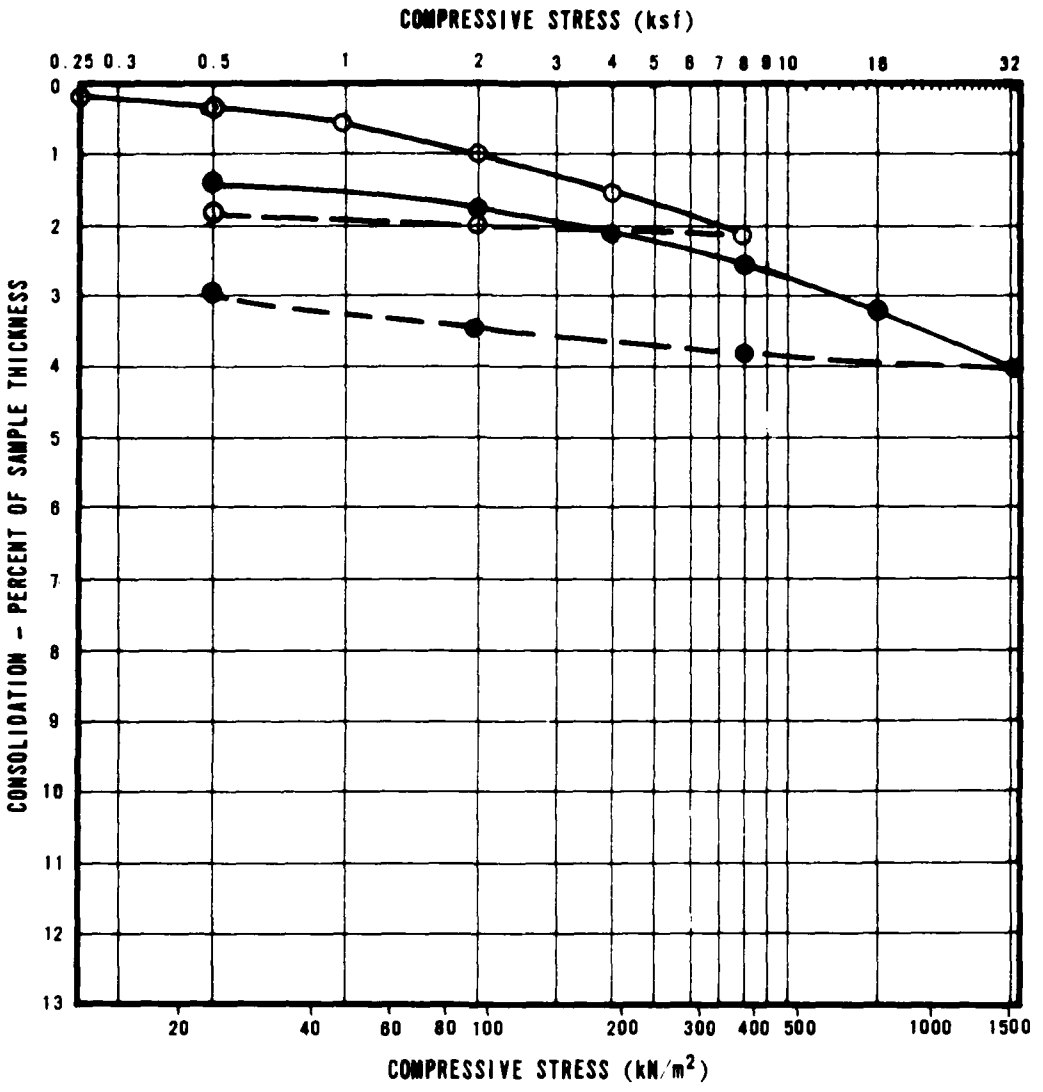
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMO

FIGURE
II-6-2

WOODWARD-CLYDE CONSULTANTS

15 JUN 80

AFV-02



SYMBOL	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	INITIAL DRY DENSITY		INITIAL MOISTURE CONTENT (%)	INITIAL VOID RATIO	INITIAL DEGREE OF SATURATION (%)
			FEET	METERS		pcf	kg/m³			
○	RV-B-7	P-6	30.0-30.8	9.14-9.39	ML	107.4	1721	15.5	0.45	85.5

○ AT FIELD MOISTURE

● AFTER ADDITION OF WATER

——— COMPRESSION

– – – REBOUND

CONSOLIDATION TEST RESULTS
RALSTON VALLEY, NEVADA

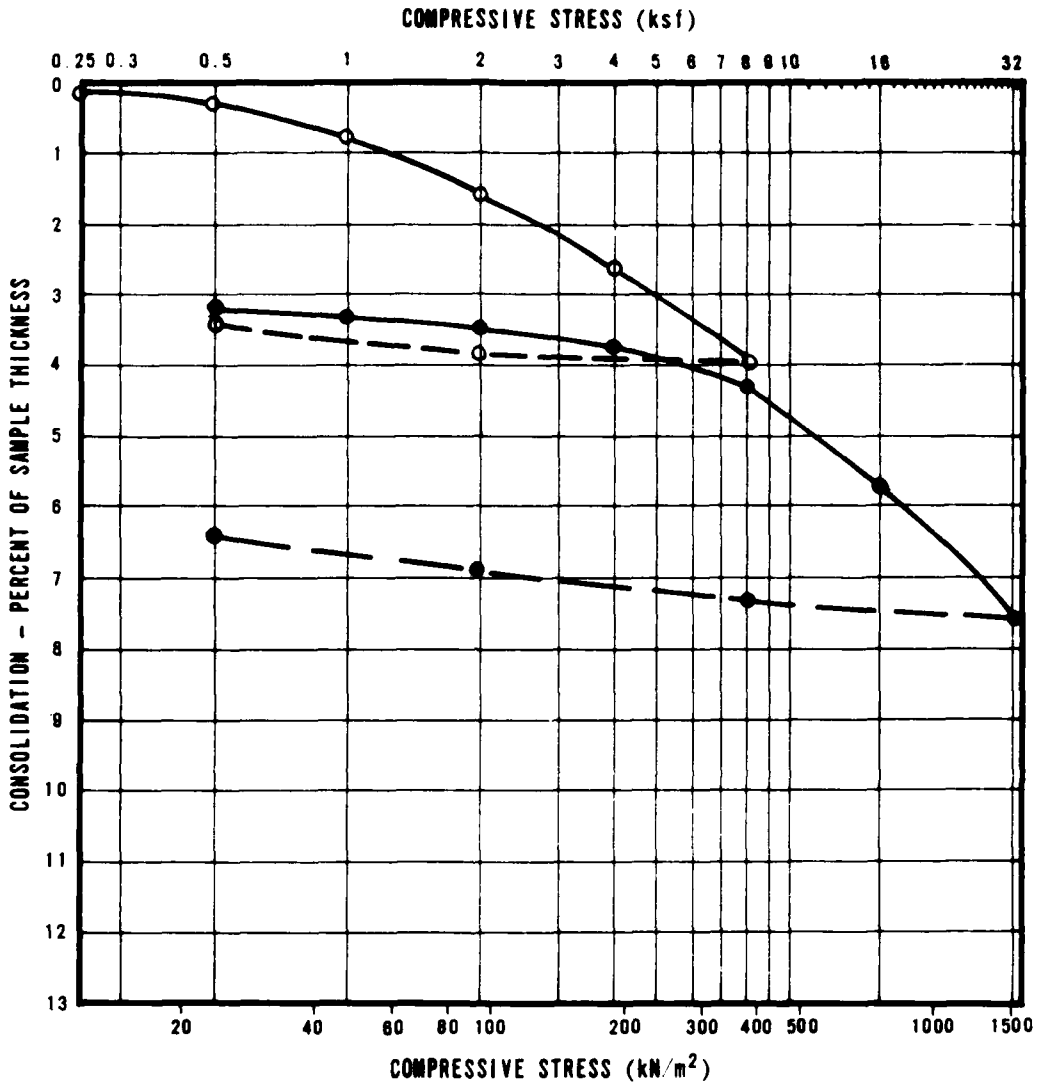
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-6-3

WOODWARD-NATIONAL, INC.

15 JUN 80

AFV-02



SYMBOL	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	INITIAL DRY DENSITY		INITIAL MOISTURE CONTENT (%)	INITIAL VOID RATIO	INITIAL DEGREE OF SATURATION (%)
			FEET	METERS		pcf	kg/m³			
○	RV-B-8	D-5	25.4-25.9	7.74-7.89	SC	114.6	1837	8.9	0.38	59.6

○ AT FIELD MOISTURE

● AFTER ADDITION OF WATER

——— COMPRESSION

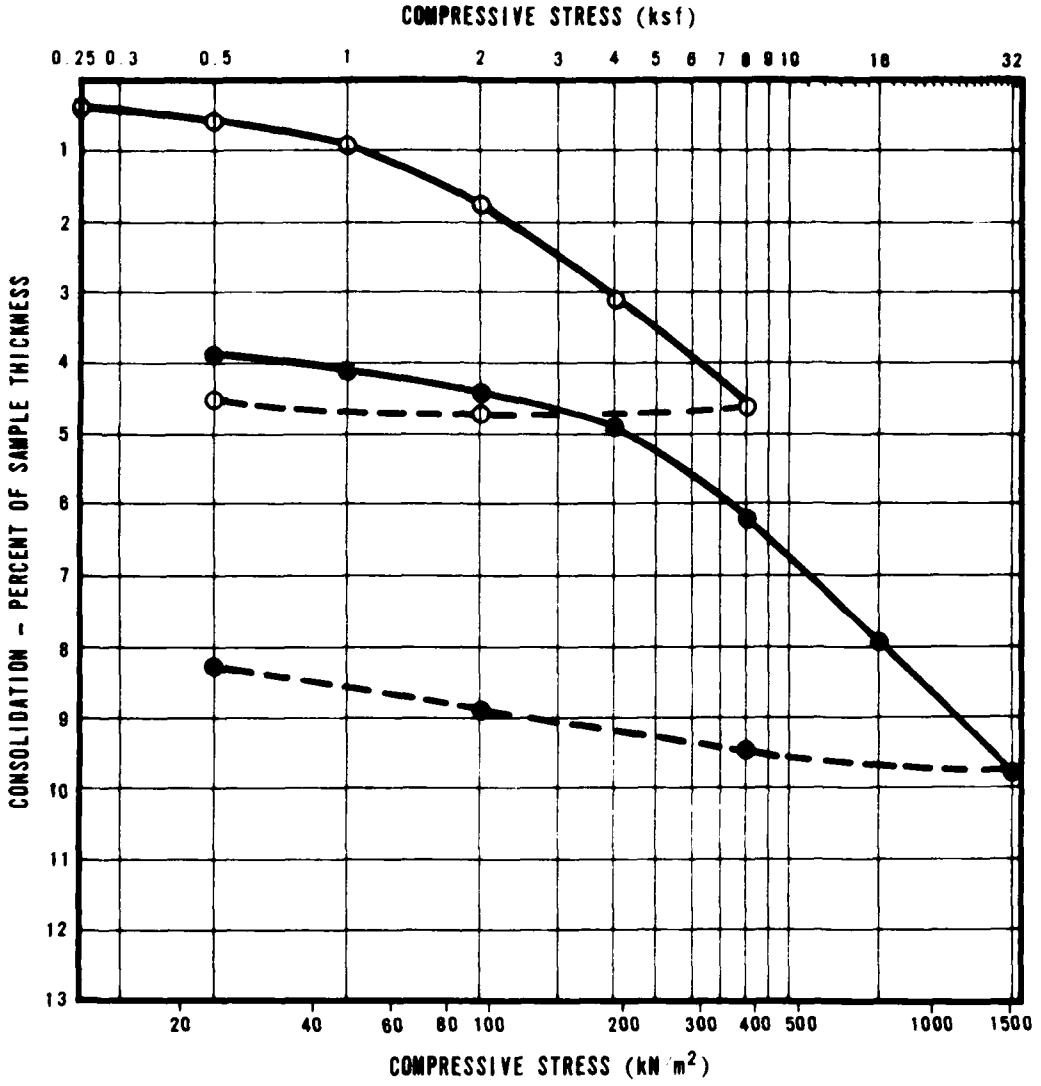
– – – REBOUND

CONSOLIDATION TEST RESULTS
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-6-4

WOODWARD-CLYDE CONSULTANTS



SYMBOL	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	INITIAL DRY DENSITY		INITIAL MOISTURE CONTENT (%)	INITIAL VOID RATIO	INITIAL DEGREE OF SATURATION (%)
			FEET	METERS		pcf	kg/m³			
○	RV-B-8	D-6	30.4-30.9	9.27-9.42	SC	114.7	1837	8.9	0.38	59.7

○ AT FIELD MOISTURE

● AFTER ADDITION OF WATER

——— COMPRESSION

– – – REBOUND

CONSOLIDATION TEST RESULTS
RALSTON VALLEY, NEVADA

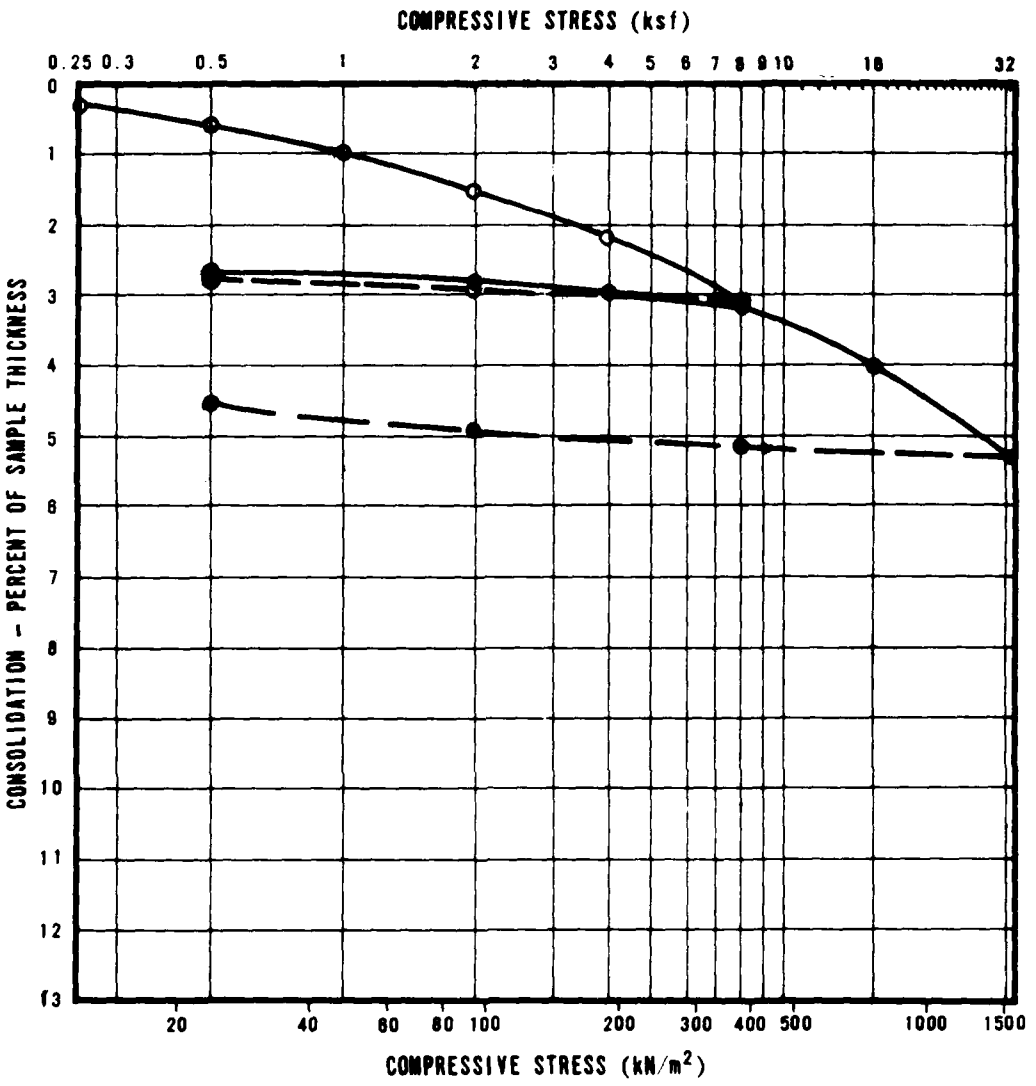
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-6-5

FUGRO NATIONAL, INC.

15 JUN 80

AFV-02



SYMBOL	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	INITIAL DRY DENSITY		INITIAL MOISTURE CONTENT (%)	INITIAL VOID RATIO	INITIAL DEGREE OF SATURATION (%)
			FEET	METERS		pcf	kg/m³			
○	RV-B-9	P-8	30.0-30.5	9.14-9.30	SP-SM	103.6	1660	11.5	0.63	49.5

○ AT FIELD MOISTURE

● AFTER ADDITION OF WATER

——— COMPRESSION

– – – REBOUND

CONSOLIDATION TEST RESULTS
RALSTON VALLEY, NEVADA

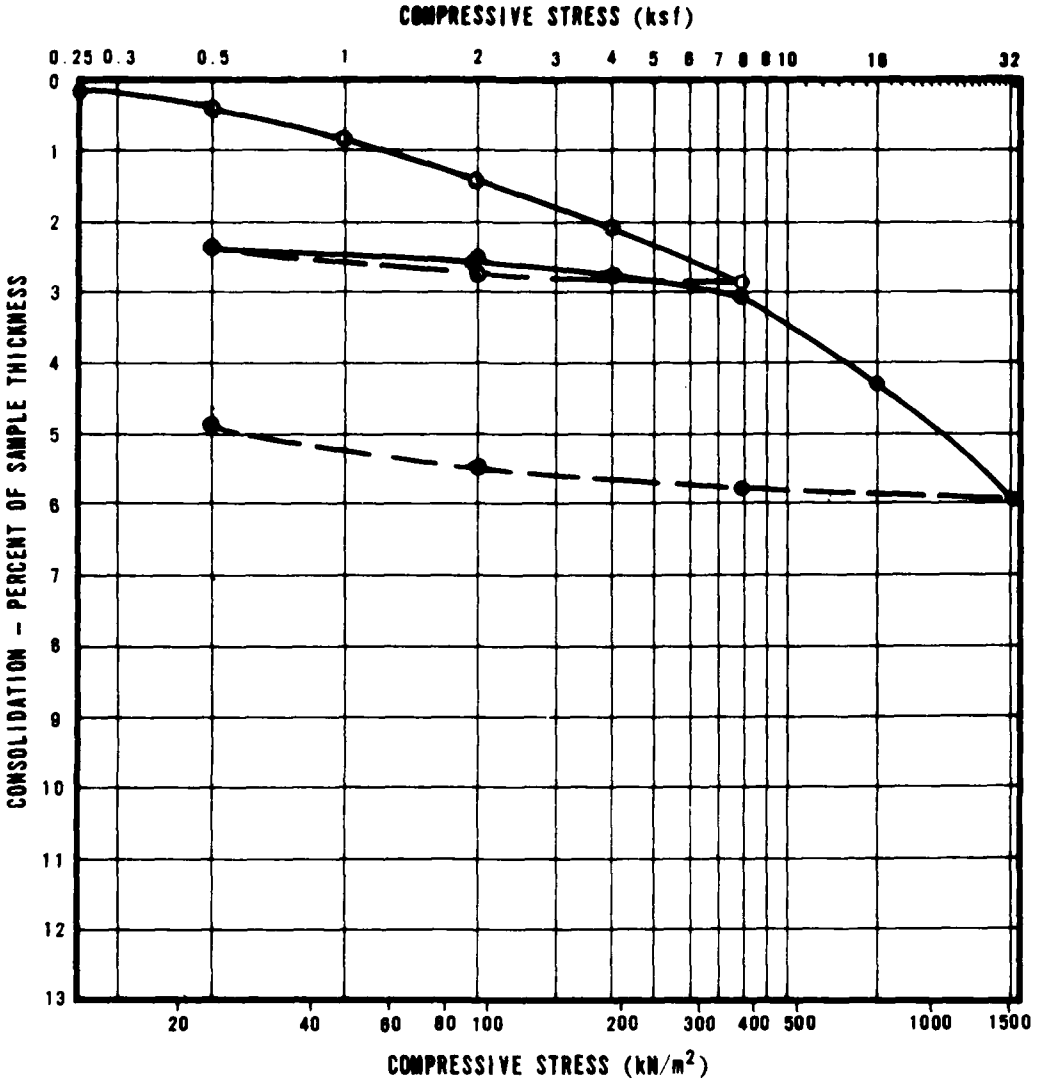
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMO

FIGURE
II-6-6

VERD NATIONAL, INC.

15 JUN 80

AFV-02



SYMBOL	BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	INITIAL DRY DENSITY		INITIAL MOISTURE CONTENT (%)	INITIAL VOID RATIO	INITIAL DEGREE OF SATURATION (%)
			FEET	METERS		pcf	kg/m³			
○	RV-B-12	P-6	30.0-30.7	9.14-9.36	SM	84.3	1350	21.3	1.00	57.6

○ AT FIELD MOISTURE

● AFTER ADDITION OF WATER

——— COMPRESSION

– – – REBOUND

CONSOLIDATION TEST RESULTS
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMO

FIGURE
II-6-7

WOODWARD-CLYDE CONSULTANTS

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FN-TR-27-RV

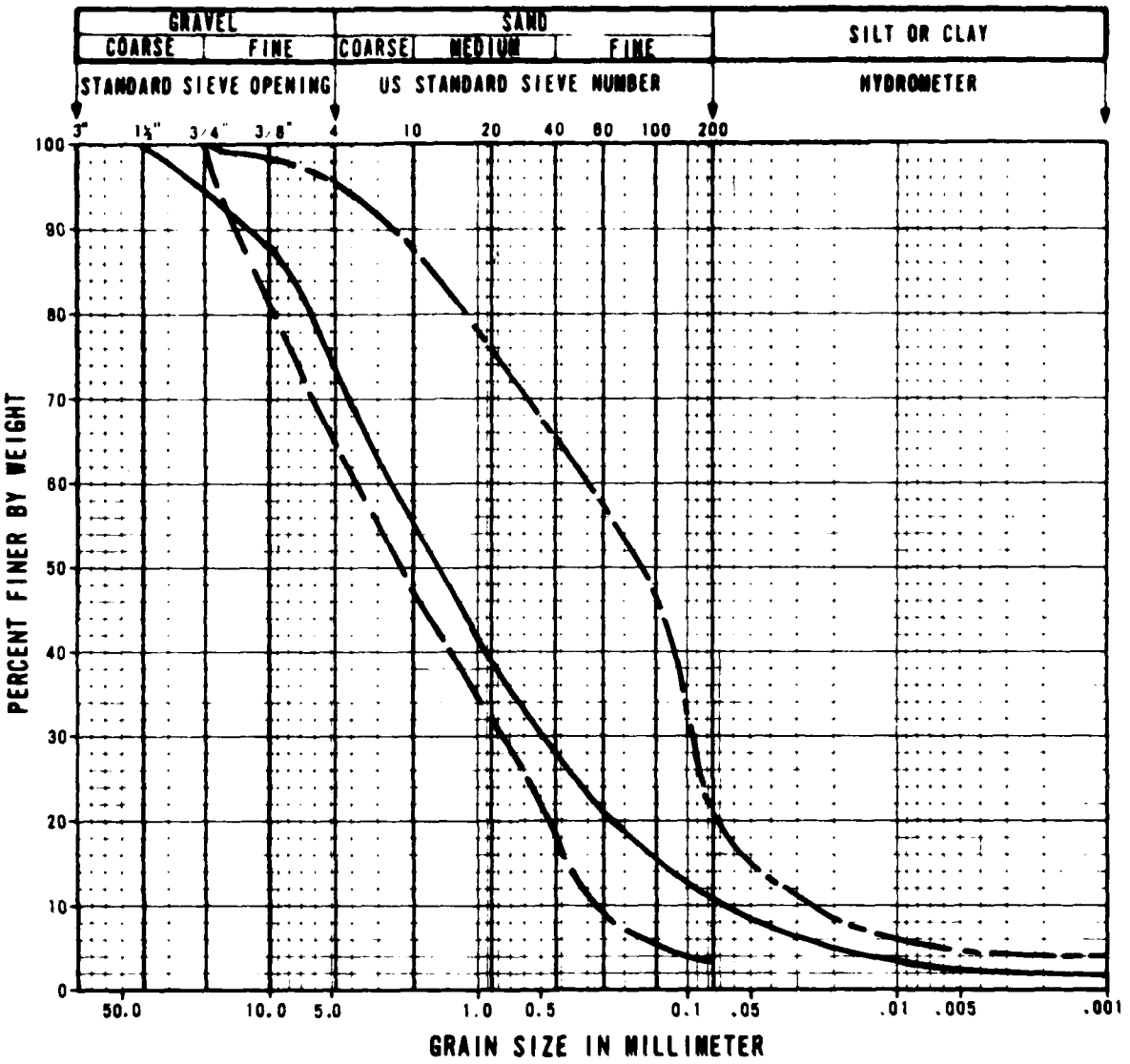
BORING/ TRENCH NO.	SAMPLE NO	SAMPLE INTERVAL		SOIL TYPE	pH	WATER SOLUBLE				CALCIUM CARBONATE
		FEET	METERS			SODIUM	CHLORIDE	SULPHATE	CALCIUM	
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
RV-B-5	P-3	15.0-15.8	4.57-4.82	SM	8.1	110	62	276	10	25
RV-B-6	P-4	20.0-20.7	6.10-6.31	SP	7.7	105	19	84	10	25
RV-B-9	SS-2	10.0-10.2	3.05-3.20	SM	7.6	125	110	166	51	128
RV-B-15	SS-2	14.0-15.0	4.27-4.57	SW-SM	7.7	183	133	41	5	12
RV-T-1	B-2	5.0-6.5	1.52-1.98	ML	7.4	1100	741	1480	88	220
RV-T-2	d-1	0.0-0.5	0.00-0.15	ML	7.0	650	727	88	144	360
RV-T-3	B-2	2.5-4.5	0.76-1.37	SP	7.6	125	238	825	72	180
RV-T-5	B-2	5.0-6.0	1.52-1.83	SP-SM	7.8	840	437	1360	52	130

SUMMARY OF CHEMICAL TEST RESULTS
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMO

TABLE II-6-5

RALSTON NATIONAL INC.



SYMBOL	COMPOSITE SAMPLE NUMBER	TRENCH NUMBER	SAMPLE INTERVAL		SOIL TYPE
			FEET	METERS	
———	A	RV-T-5	14.5-15.5	4.42-4.72	SW-SM
		RV-T-7	10.0-11.5	3.05-3.51	
— —	B	RV-T-3	2.5-4.5	0.76-1.37	SP
		RV-T-4	2.5-5.0	0.76-1.52	
— — —	C	RV-T-2	2.0-3.0	0.61-0.91	SM
		RV-T-2	16.5-18.0	5.03-5.49	

GRAIN SIZE CURVES, CBR TESTS
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMO

FIGURE
II-6-8

WOODWARD-CLYDE CONSULTANTS

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AFV-12

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FN-TR-27-RV

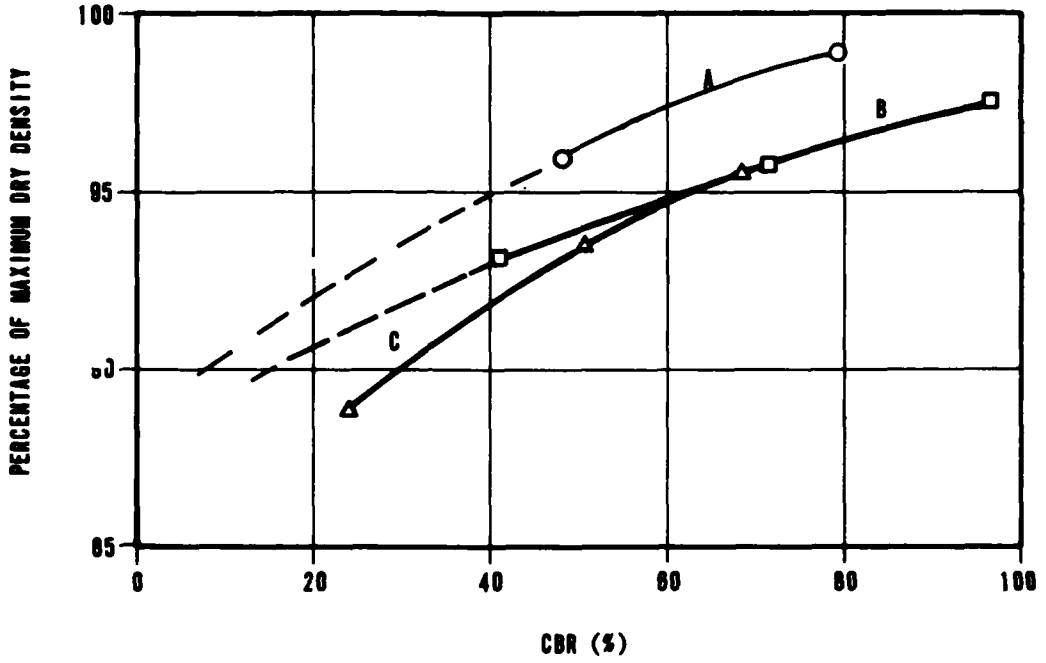
COMPOSITE SAMPLE NUMBER	SOIL TYPE	PERCENT PASSING #200	ATTERBERG LIMITS		SPECIFIC GRAVITY	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)	COMPACTED DRY DENSITY		COMPACTED MOISTURE (%)	PERCENT OF MAXIMUM DRY DENSITY	CBR (%)
			LL	PI		pcf	kg/m^3		pcf	kg/m^3			
A	SW-SM	11				122.1	1956	9.8	120.6	1932	9.4	98.8	79
									117.0	1874	9.7	95.8	48
									113.2	1813	9.5	92.7	18
B	SP	3			2.60	121.0	1938	10.0	118.1	1892	9.7	97.6	97
									115.9	1857	9.7	95.8	72
									112.8	1807	9.7	93.2	41
C	SM	21				118.0	1890	11.5	112.7	1805	11.9	95.5	69
									110.4	1768	11.6	93.6	51
									105.0	1662	12.1	89.0	24

CALIFORNIA BEARING RATIO (CBR) TEST RESULTS
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

TABLE II-6-6

KAISER NATIONAL, INC.



SYMBOL	COMPOSITE SAMPLE NUMBER	SOIL TYPE
○	A	SW-SM
□	B	SP
△	C	SM

CALIFORNIA BEARING RATIO (CBR) CURVES
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-6-9

WOODWARD-NATIONAL, INC.

SECTION 7.0

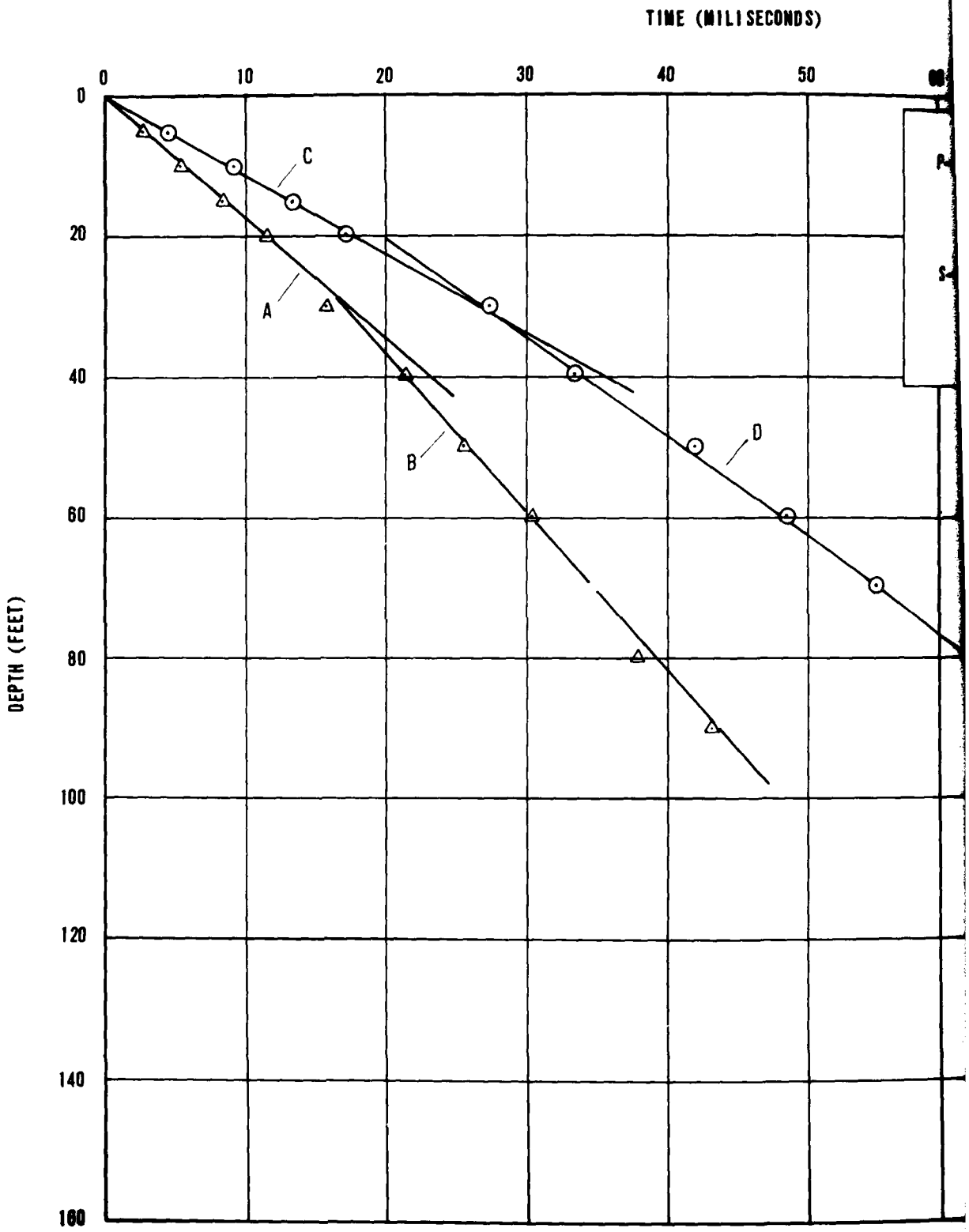
DOWNHOLE SEISMIC VELOCITY DATA

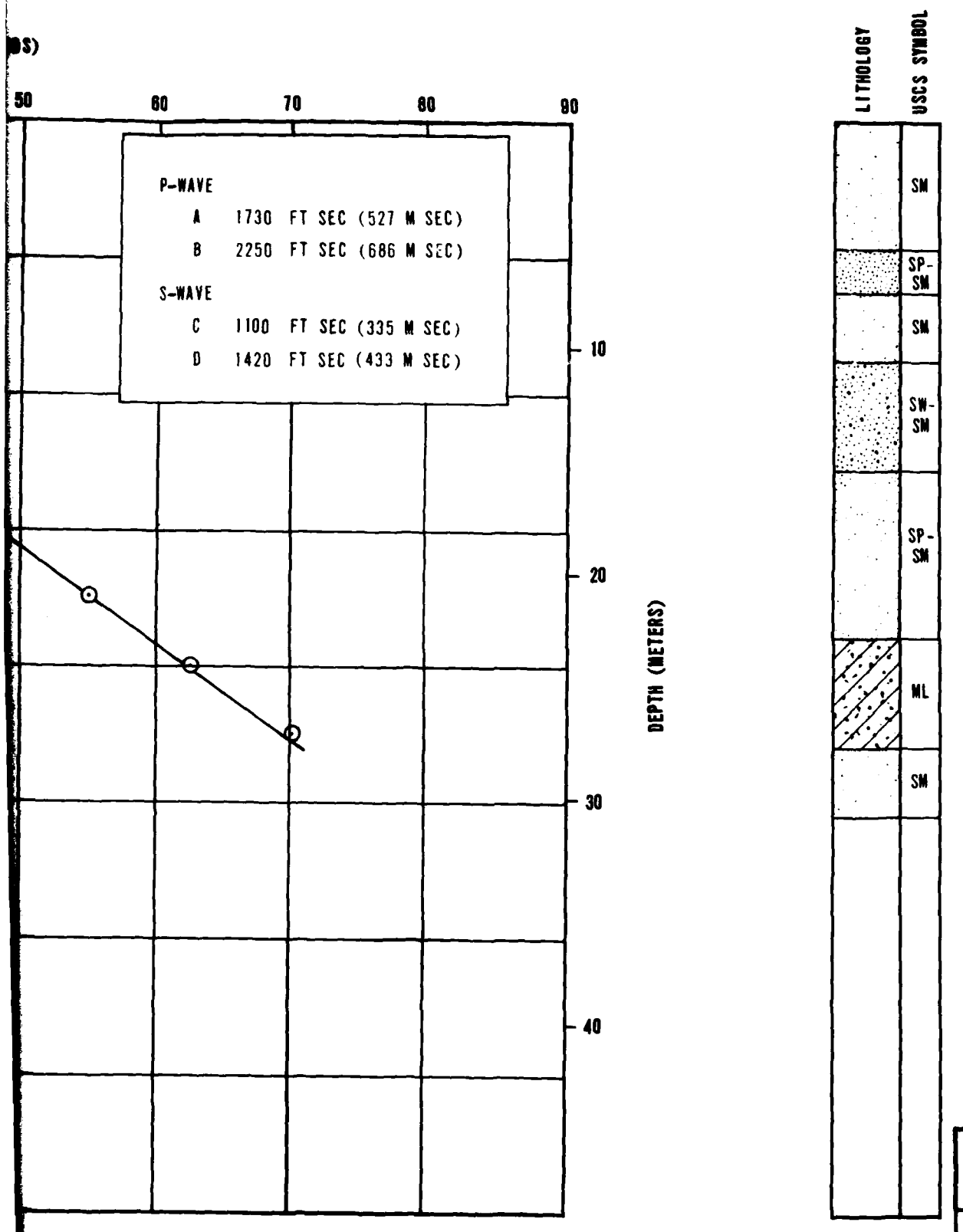
7.0 DOWNHOLE SEISMIC VELOCITY DATA

The corrected (see Appendix A4.2.0 in Volume I) travel times for the compressional and shear waves are plotted on the same coordinate system. The X-axis represents travel time in milliseconds and the y-axis represents depth. Compressional wave travel times are plotted as triangles and shear wave travel times are shown as circles.

The velocity profile is interpreted by fitting straight lines through groups of points. Each line segment shown is labeled with a letter. The velocities calculated from the slopes of the line segments are tabulated in the upper right hand corner of the graph.

A simplified log of the borings is shown to the right of the time versus depth graph.


TIME (MILISECONDS)
0
10
20
30
40
50
0
20
40
60
80
100
120
140
160
DEPTH (FEET)
A
B
C
D
P
S



EXPLANATION

△ COMPRESSIONAL WAVE

⊙ SHEAR WAVE DATA

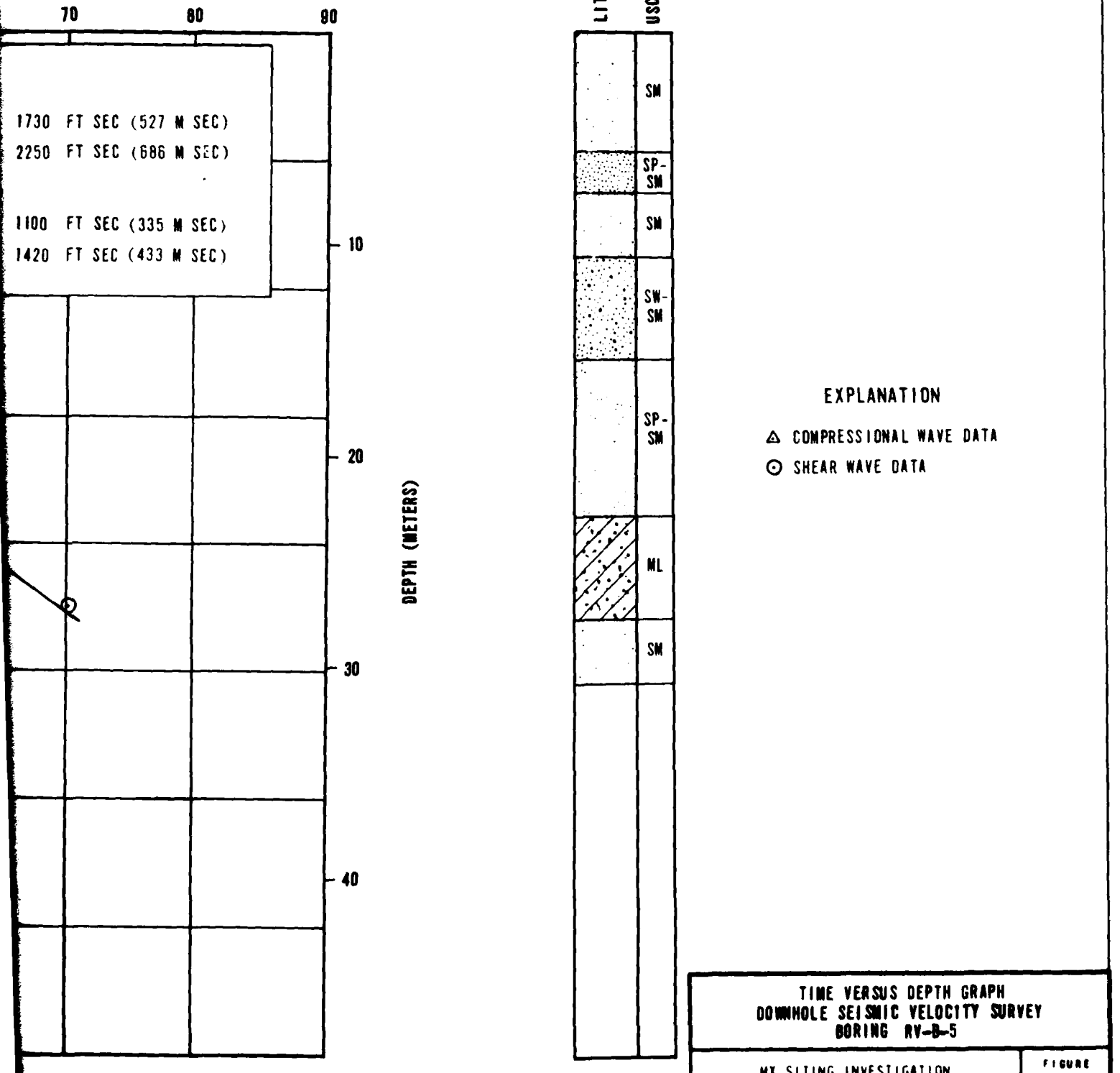
TIME VERSUS DEPTH
DOWNHOLE SEISMIC VELOCI
BORING RV-B-5

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE

UGRO NATION

1

2

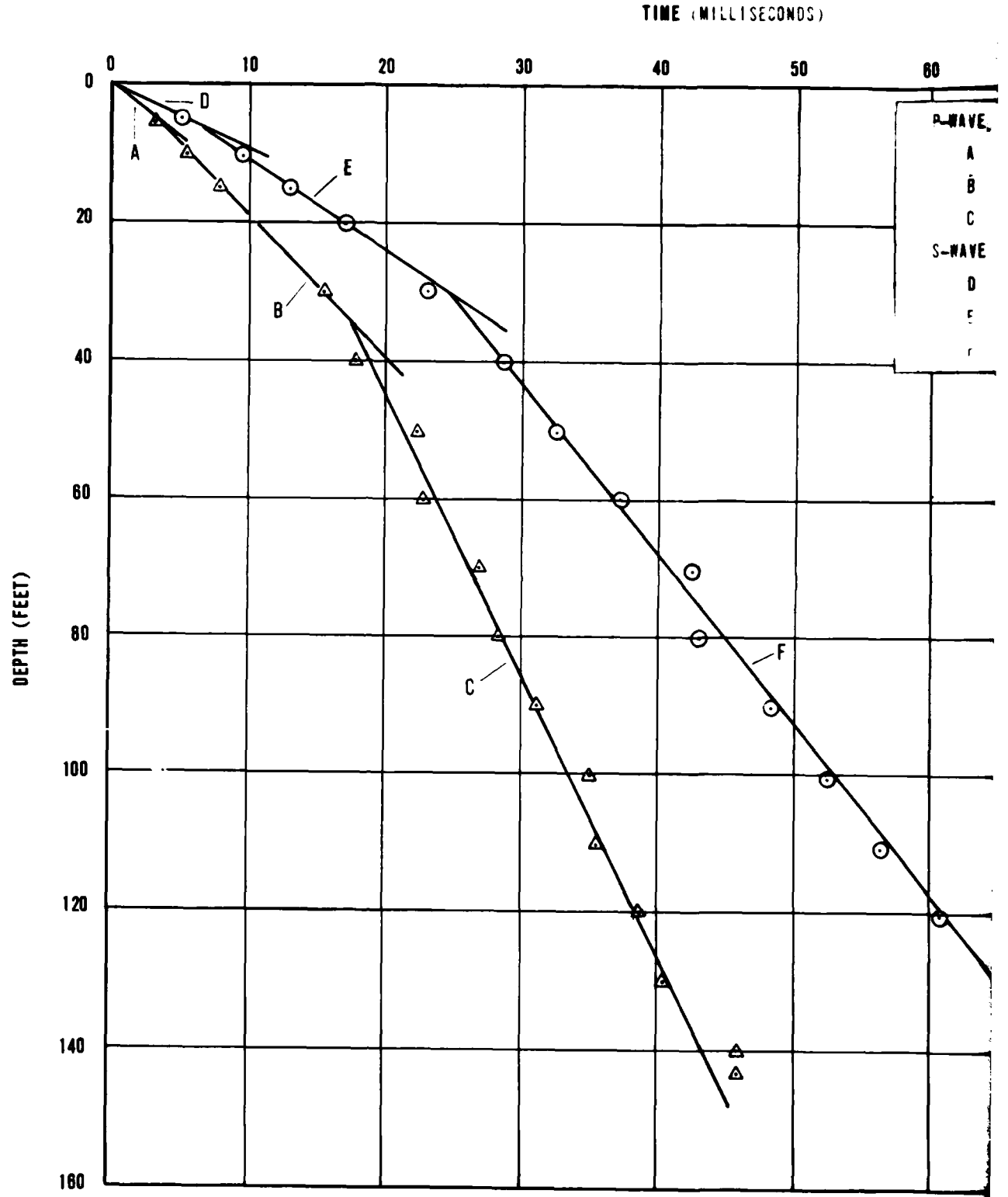


TIME VERSUS DEPTH GRAPH
DOWNHOLE SEISMIC VELOCITY SURVEY
BORING RV-B-5

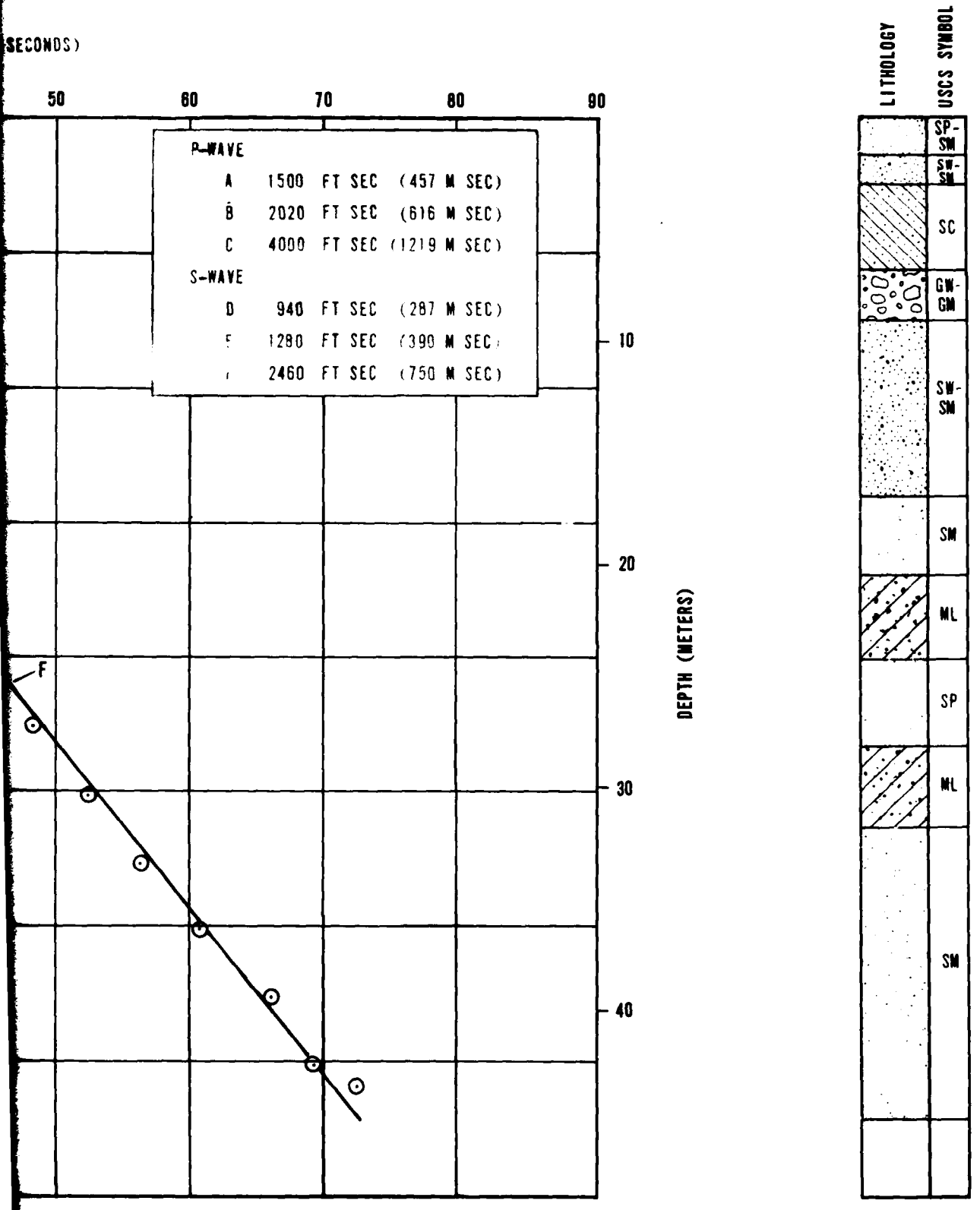
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMO

FIGURE
II-7-1

FUGRO NATIONAL, INC.


TIME (MILLISECONDS)
0
10
20
30
40
50
60
DEPTH (FEET)
0
20
40
60
80
100
120
140
160
A
B
C
D
E
F
P-WAVE
A
B
C
S-WAVE
D

15 JUN 80



EXPLANATI

△ COMPRESSIONAL

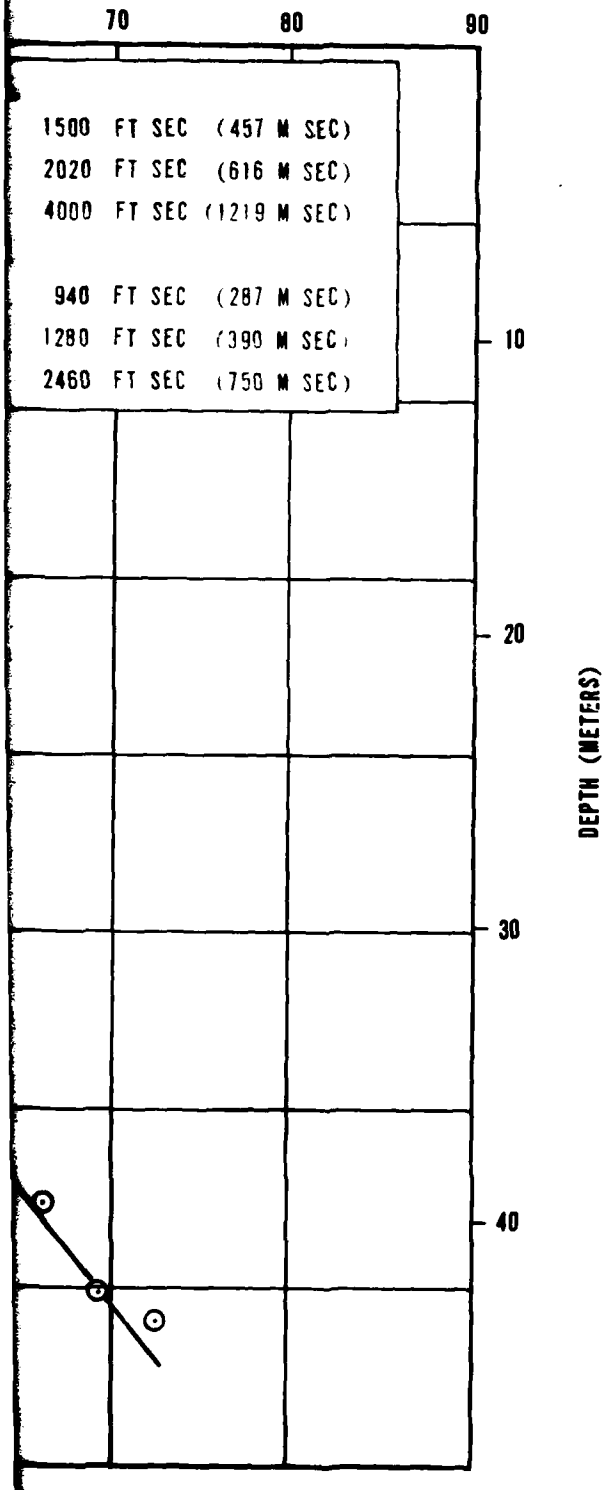
○ SHEAR WAVE DAT

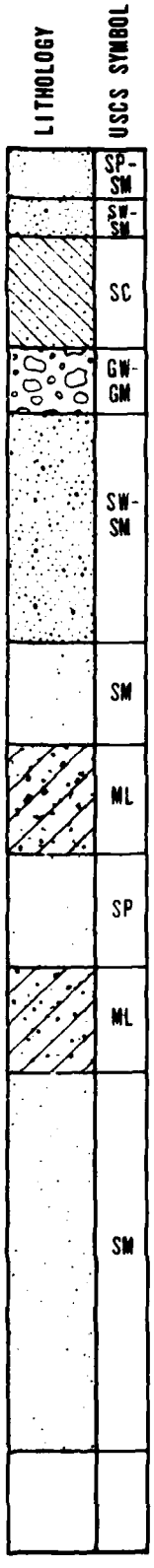
TIME VERSUS DE
DOWNHOLE SEISMIC VE
BORING

MX SITING INVESTIGATI
DEPARTMENT OF THE AIR FORCE

FUGRO NATI

2





EXPLANATION

△ COMPRESSIONAL WAVE DATA

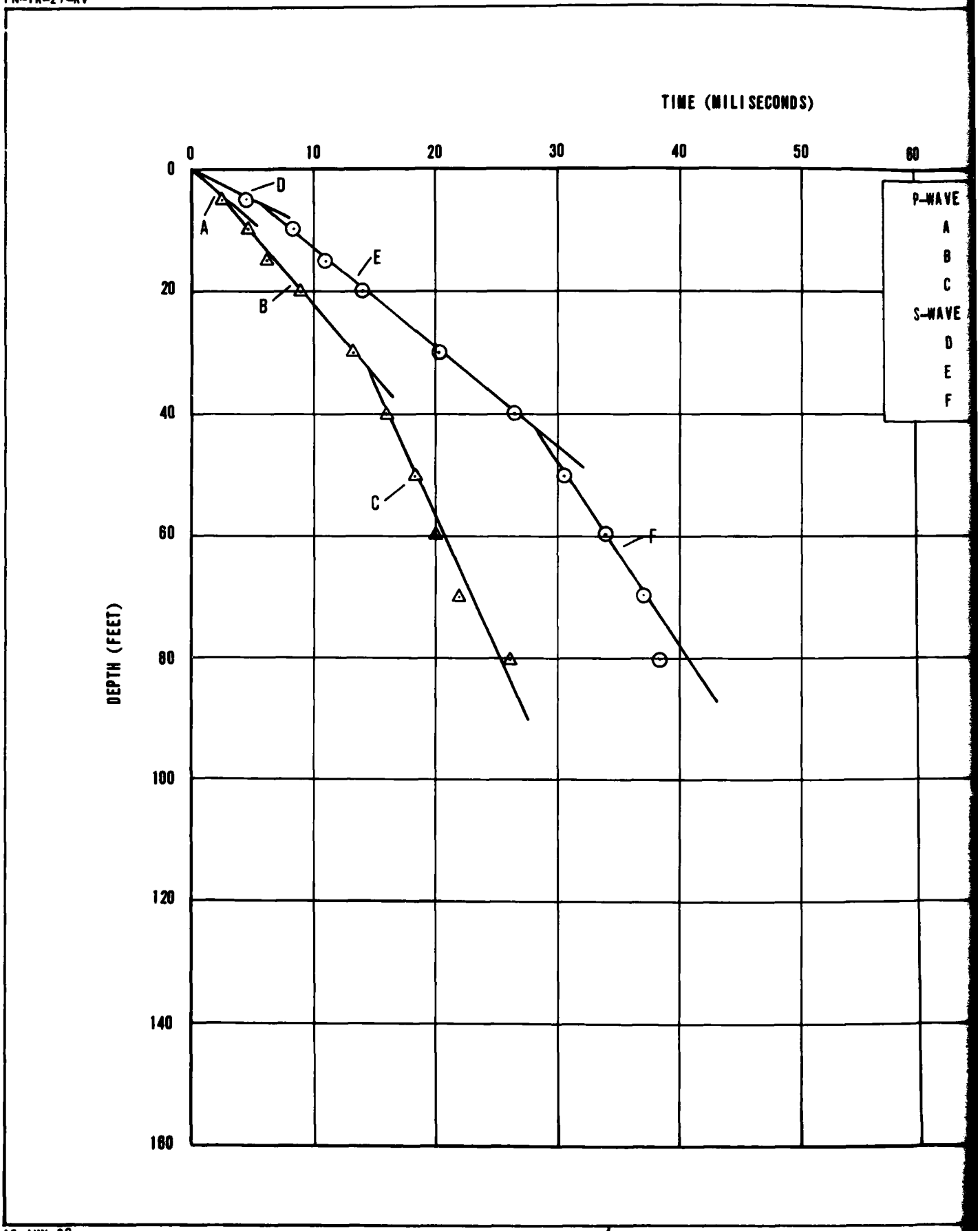
⊙ SHEAR WAVE DATA

TIME VERSUS DEPTH GRAPH
DOWNHOLE SEISMIC VELOCITY SURVEY
BORING RV-8-B

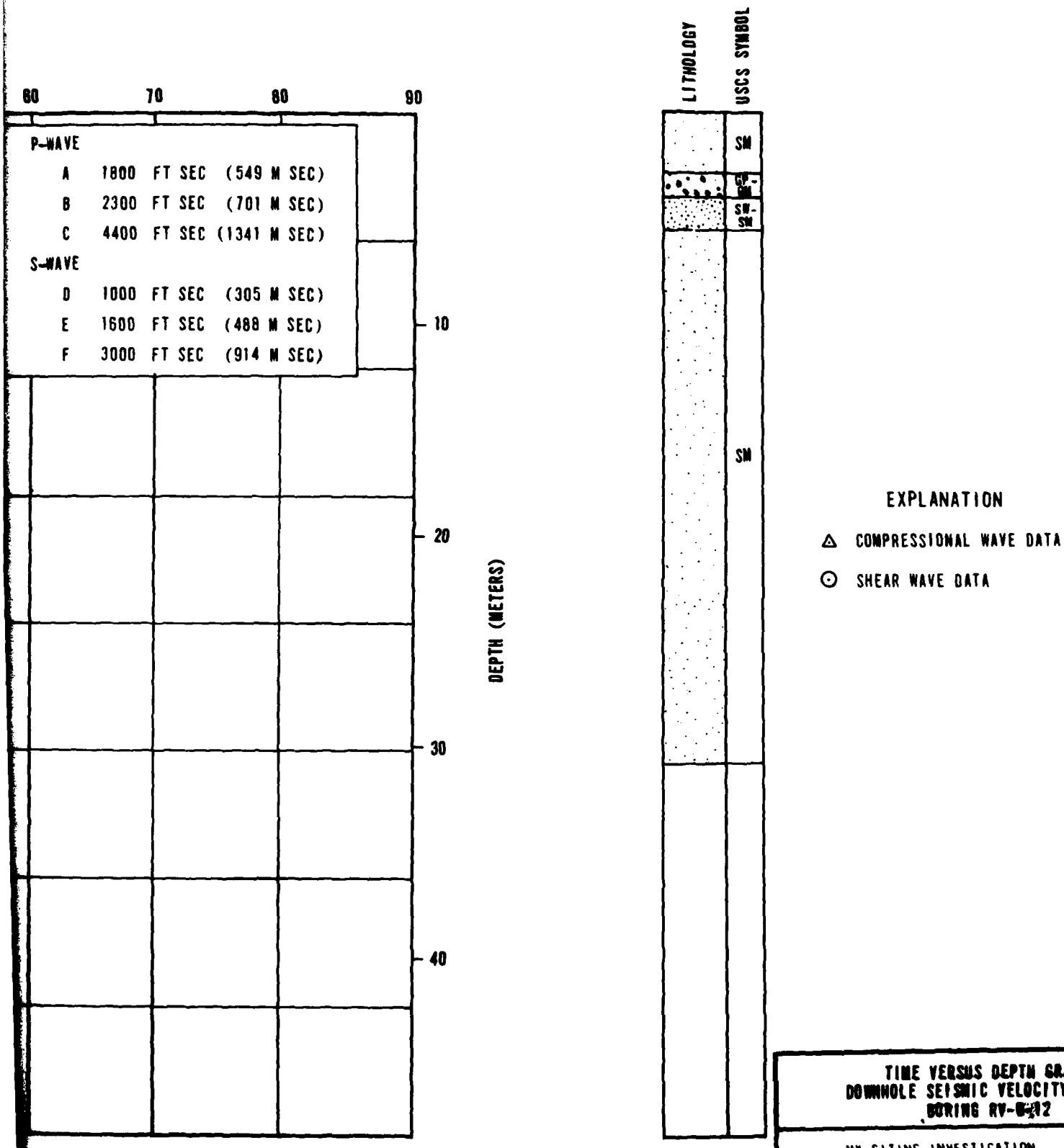
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMO

FIGURE
II-7-2

FUGRO NATIONAL, INC.


TIME (MILISECONDS)
0
10
20
30
40
50
60
DEPTH (FEET)
0
20
40
60
80
100
120
140
160
A
B
C
D
E
F
P-WAVE
A
B
C
S-WAVE
D
E
F

15 JUN 80

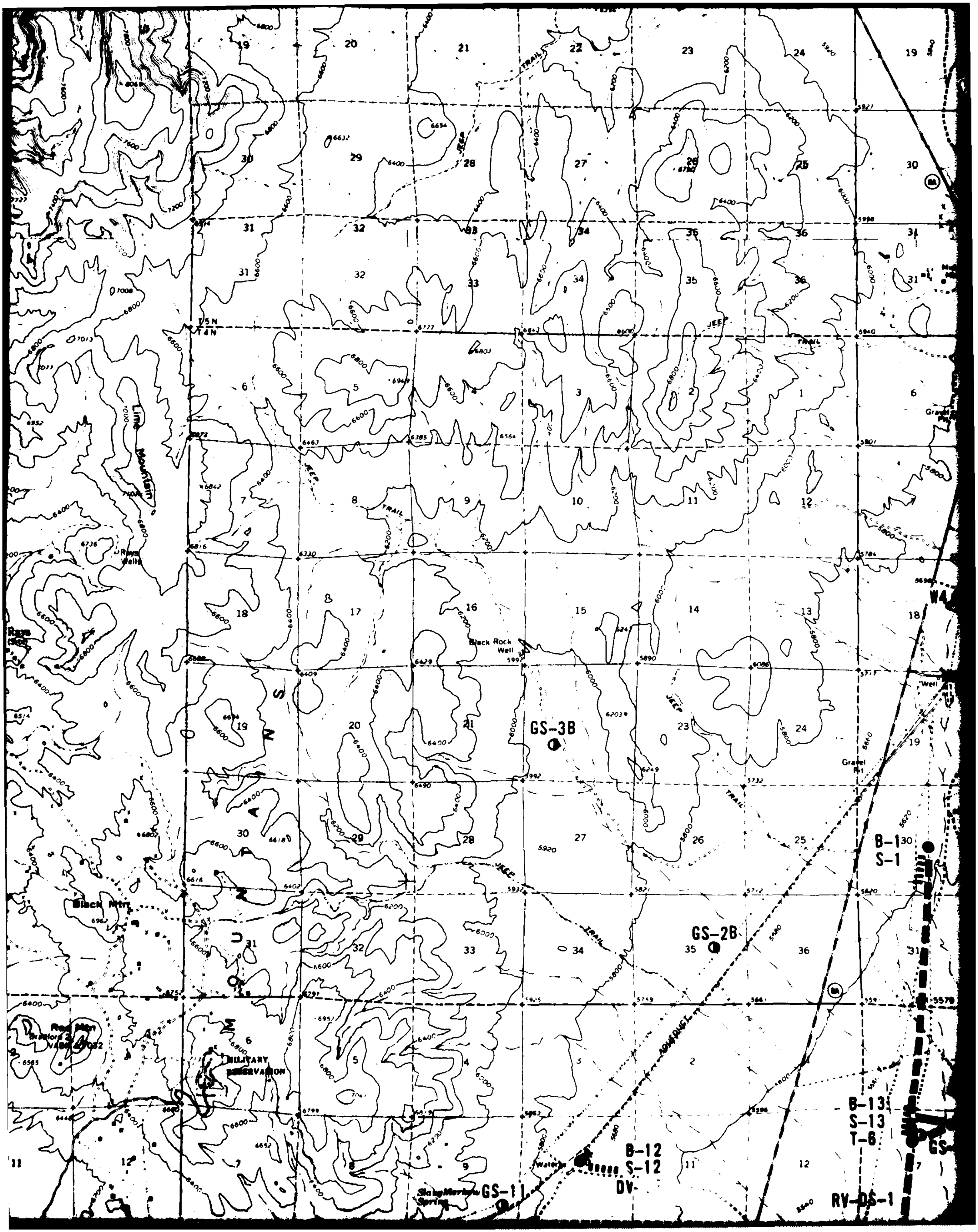


TIME VERSUS DEPTH GRAPH
DOWNHOLE SEISMIC VELOCITY SURVEY
BORING RV-B-12

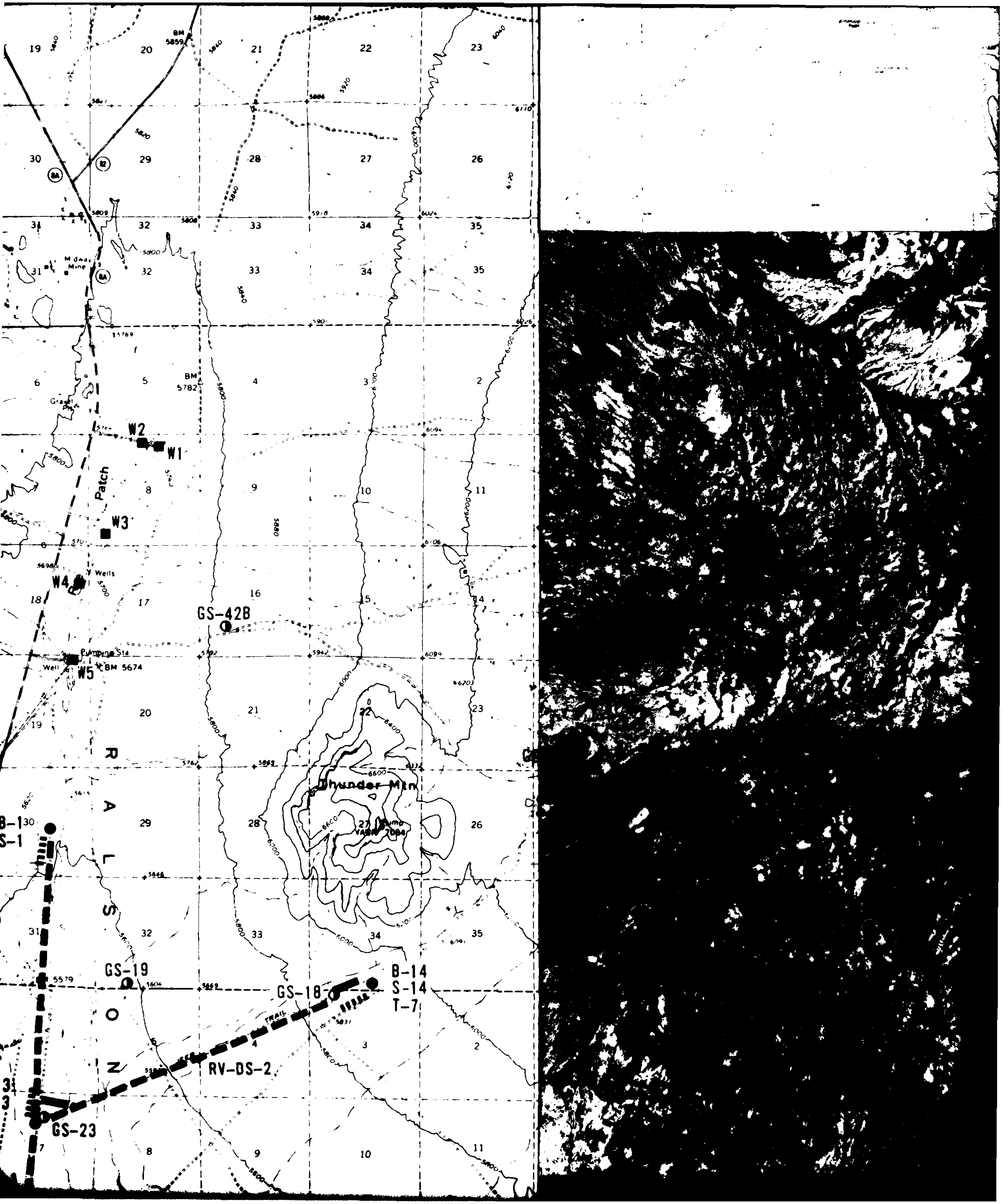
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

FIGURE
II-1

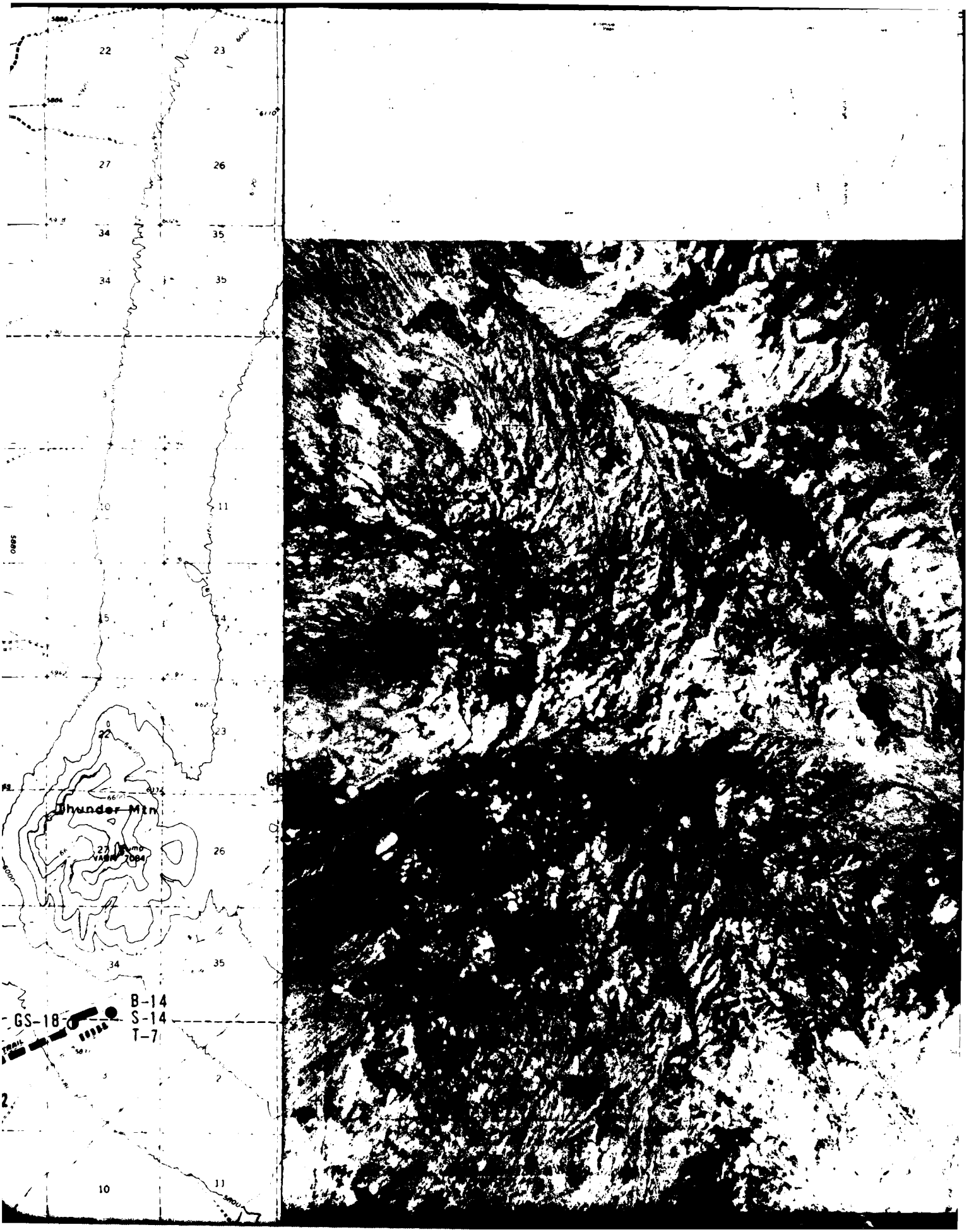
FUGRO NATIONAL, INC

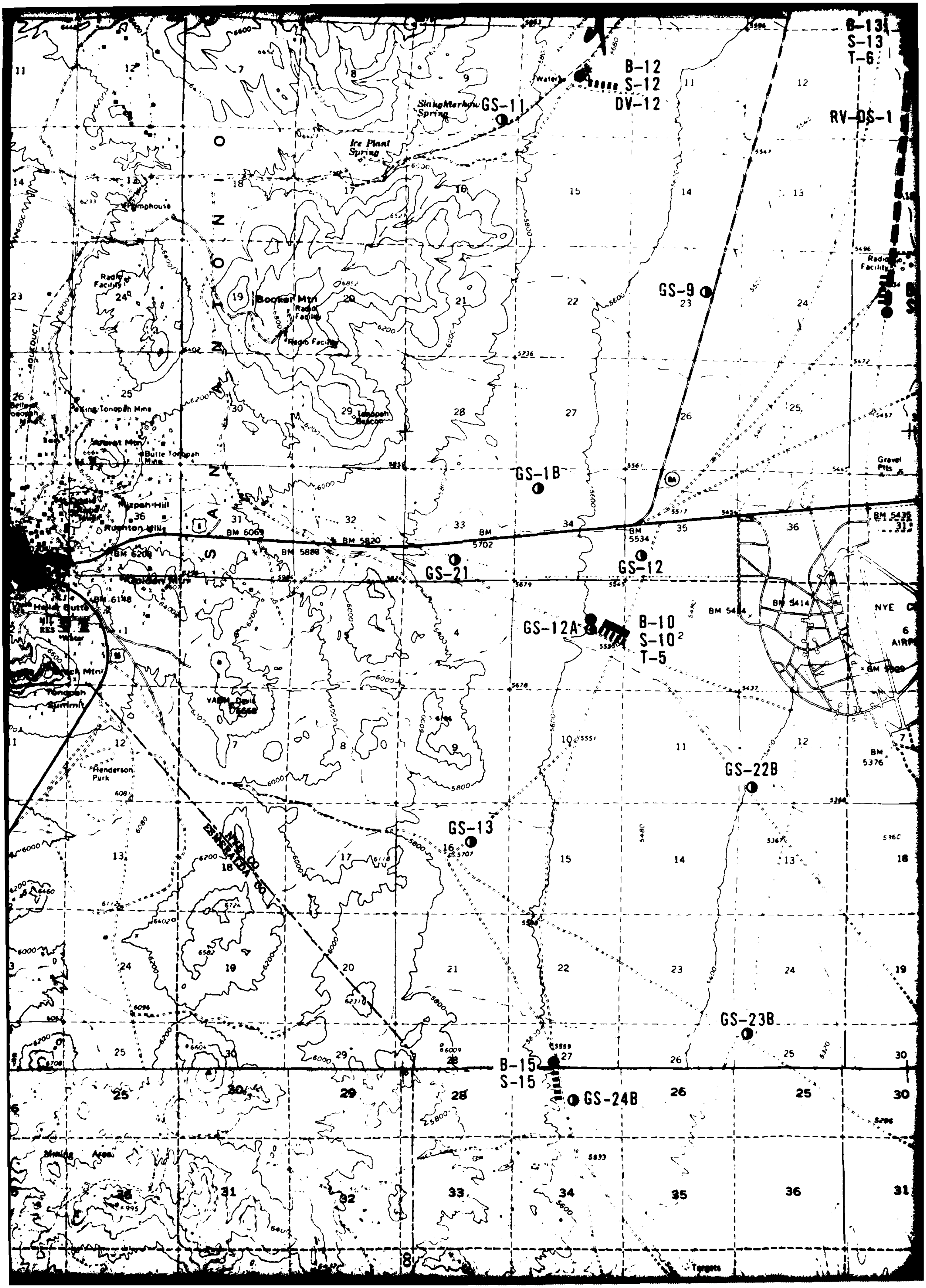


Lime Mountain
Rays Well
Black Rock Well
Black Mtn
Red Mtn
MILITARY RESERVATION
T5N
T4N
JEEP TRAIL
AQUEDUCT
Gravel Pit
"Well"
Water
GS-3B
GS-2B
GS-11
B-1
S-1
B-13
S-13
T-6
B-12
S-12
DV
RV-DS-1

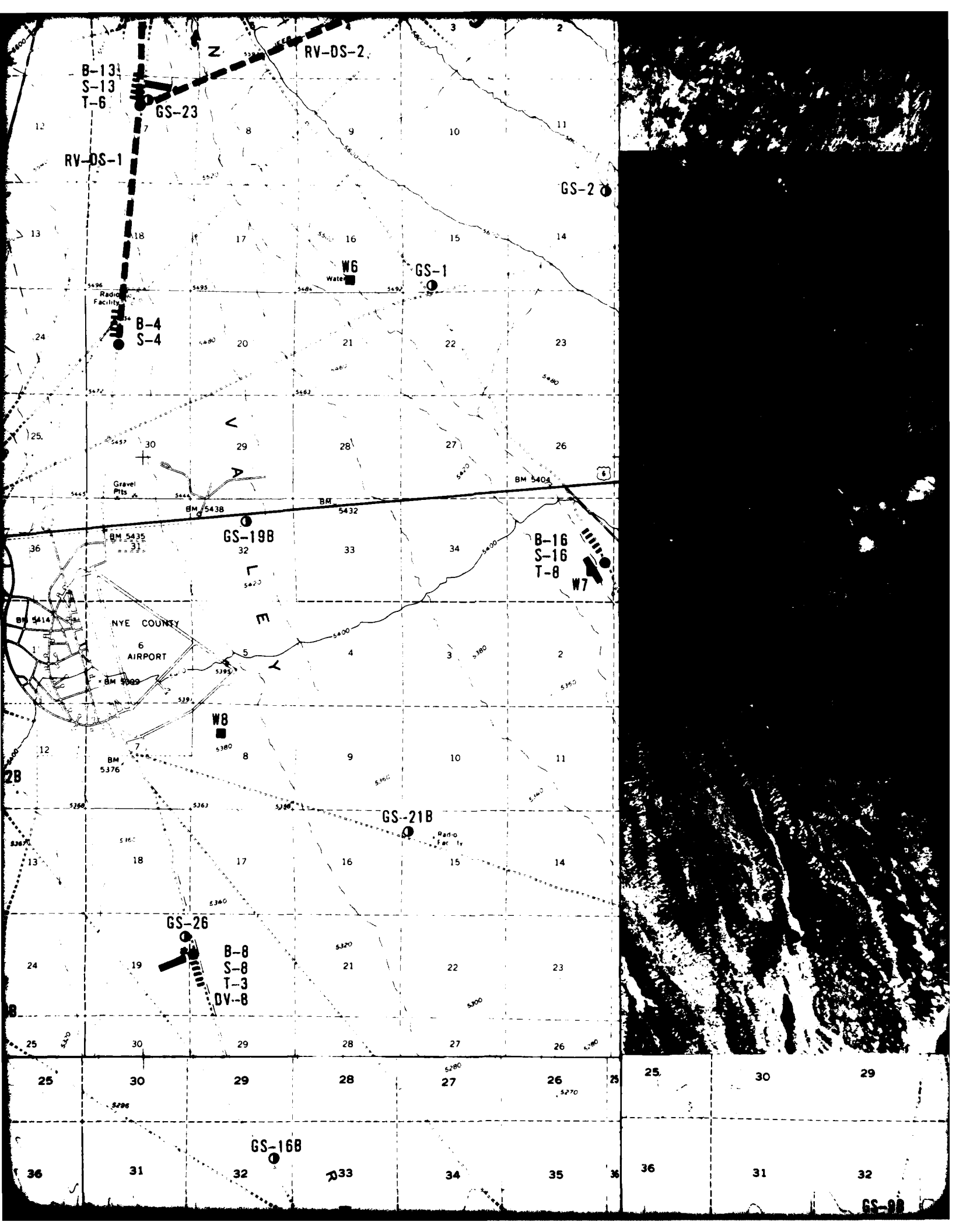


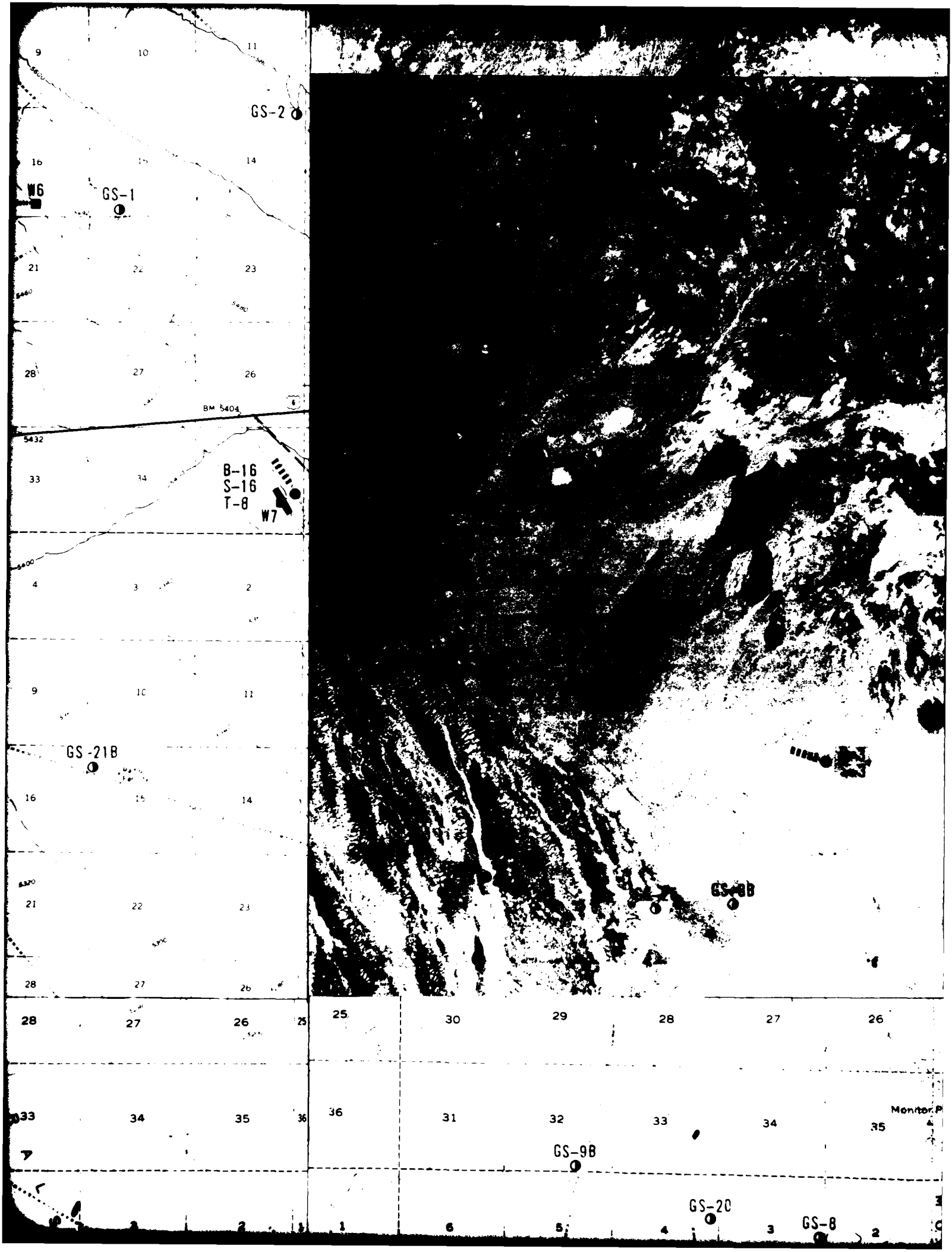
Thunder Mtn
GS-42B
W1
W2
W3
W4
W5
Wells
Pumping Sta
Well
BM 5674
BM 5782
BM 5859
Gravel Pit
Patch
B-14
S-14
T-7
GS-18
GS-19
GS-23
RV-DS-2
TRAIL
R
A
L
S
O
N

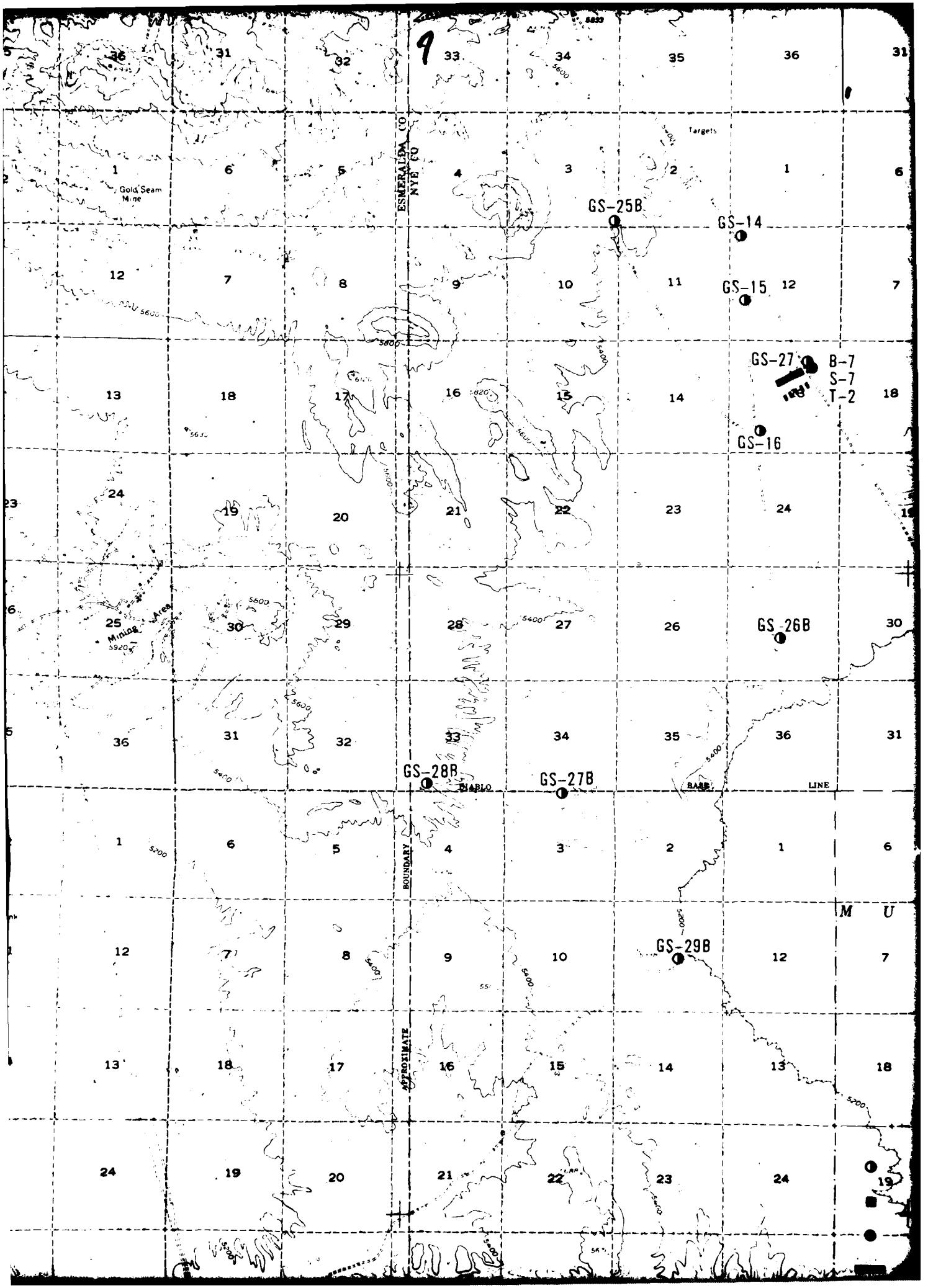

Thunder Mtn
GS-18
B-14
S-14
T-7

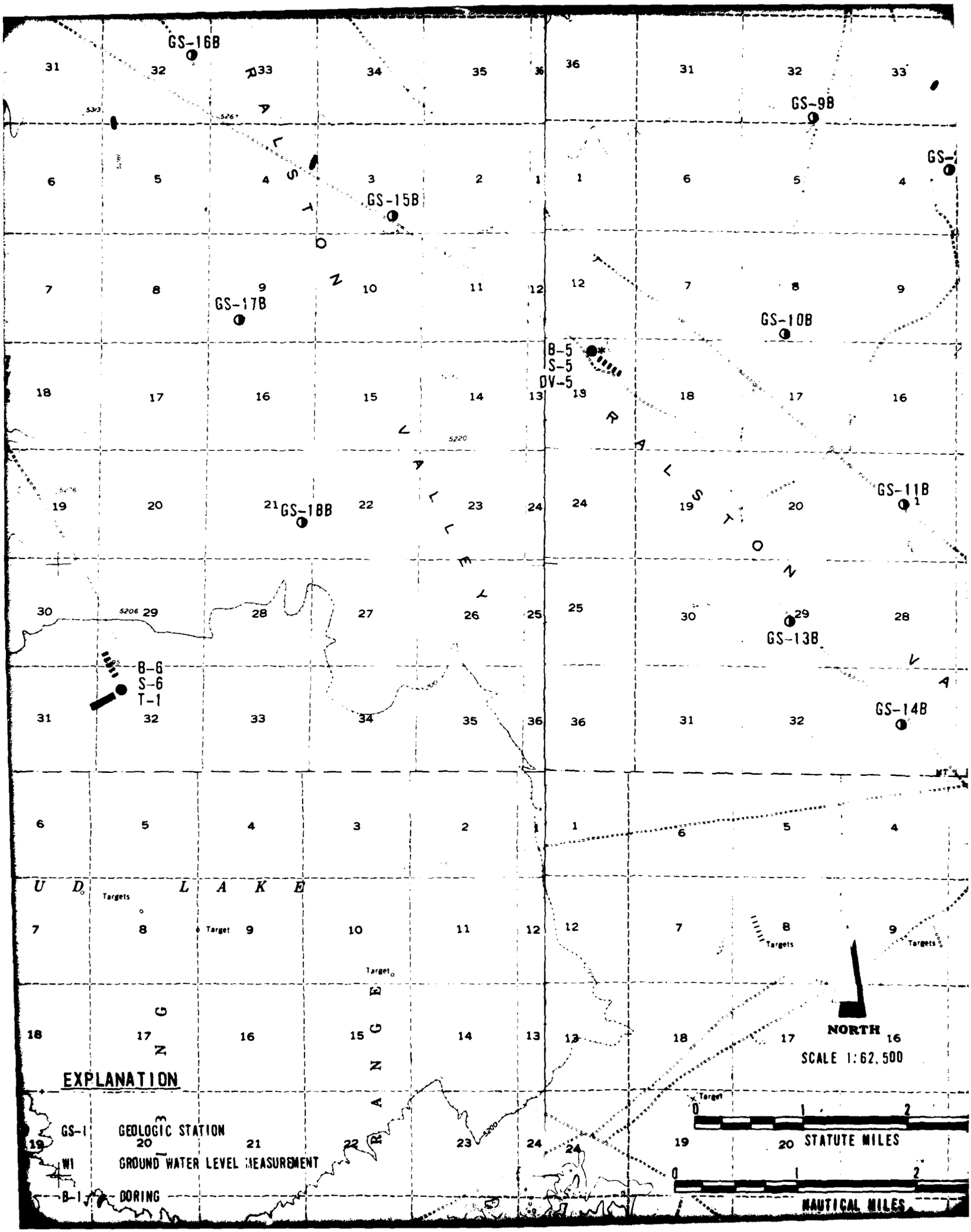


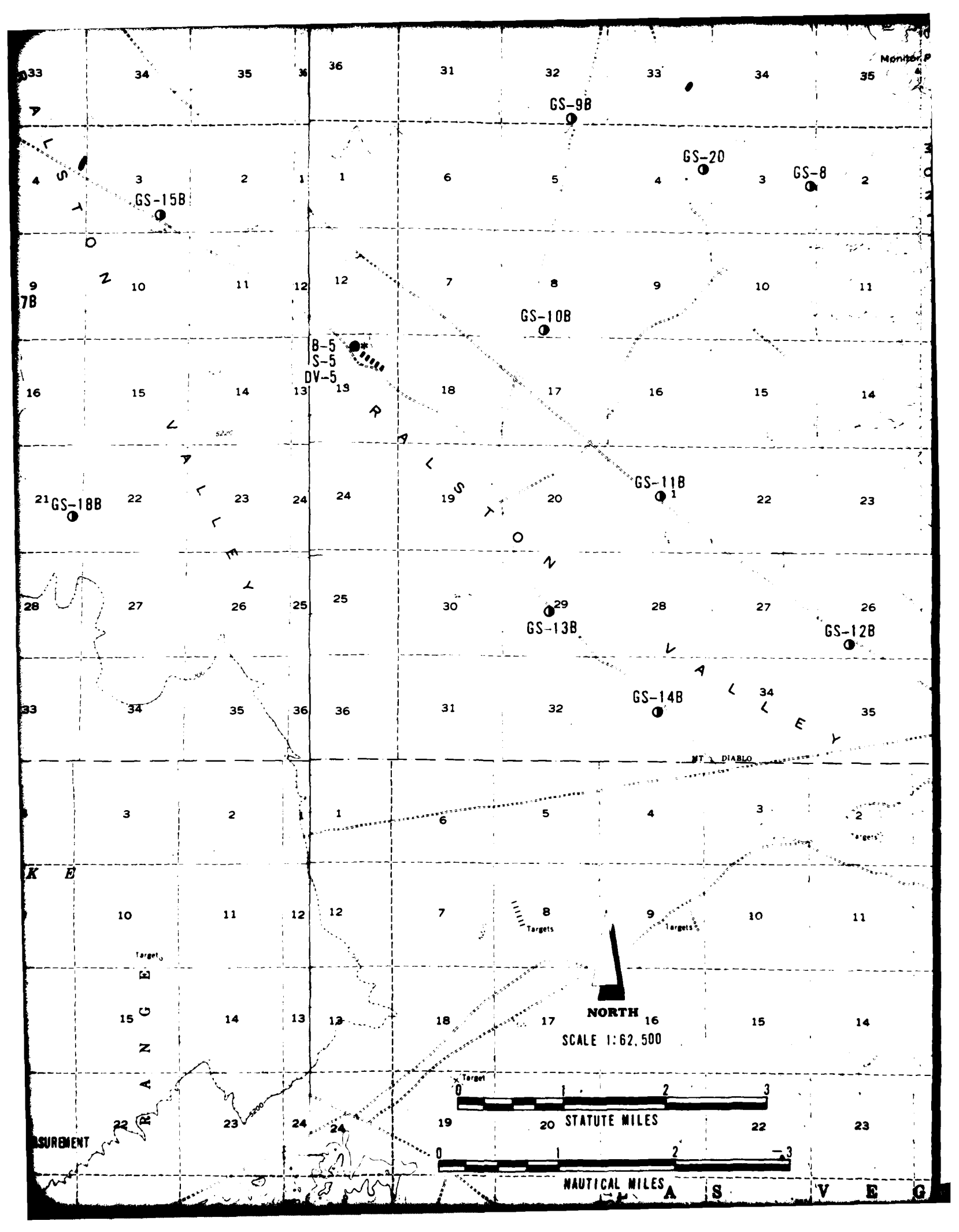
B-13
S-13
T-6
B-12
S-12
DV-12
GS-11
RV-DS-1
Slaughterhouse Spring
Ice Plant Spring
Pumphouse
Radio Facility
Booker Mtn
Radio Facility
GS-9
Tonopah Beacon
Gravel Pits
Butte Tonopah Mine
Mizpah Hill
Rushton Hill
GS-1B
GS-21
GS-12
Golden Mtn
GS-12A
B-10
S-10
T-5
NYE CO
ESMERALDA CO
Tonopah Summit
Henderson Park
GS-22B
GS-13
GS-23B
B-15
S-15
GS-24B
Mining Area
Targets

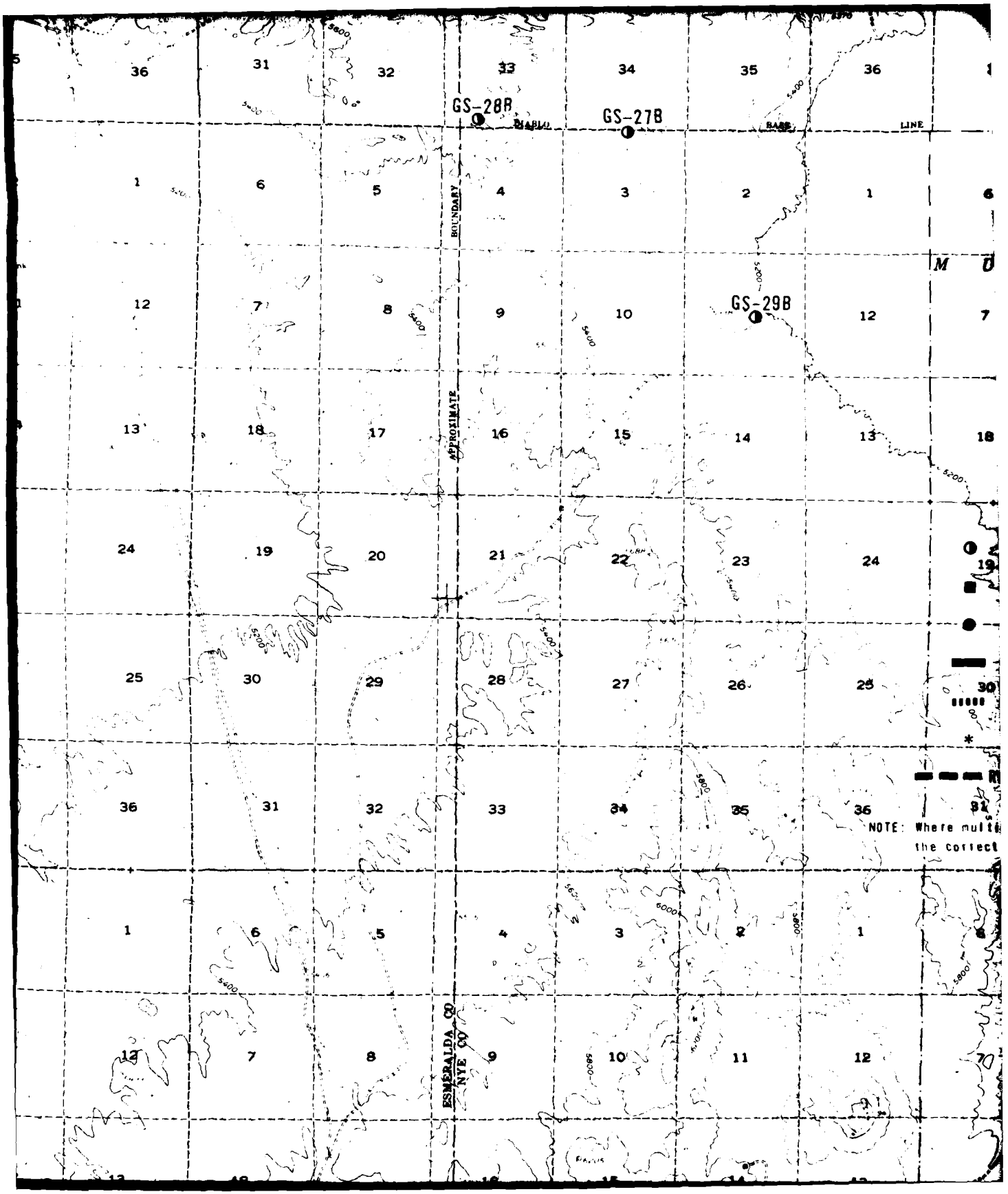

B-13
S-13
T-6
GS-23
RV-DS-2
RV-DS-1
GS-2
W6
Water
GS-1
Radio Facility
B-4
S-4
Gravel Pits
BM 5438
BM 5404
BM 5432
GS-19B
BM 5435
B-16
S-16
T-8
W7
BM 5414
NYE COUNTY
AIRPORT
BM 5369
W8
BM 5376
GS-21B
Radio Facility
GS-26
B-8
S-8
T-3
DV-8
GS-16B
GS-9B

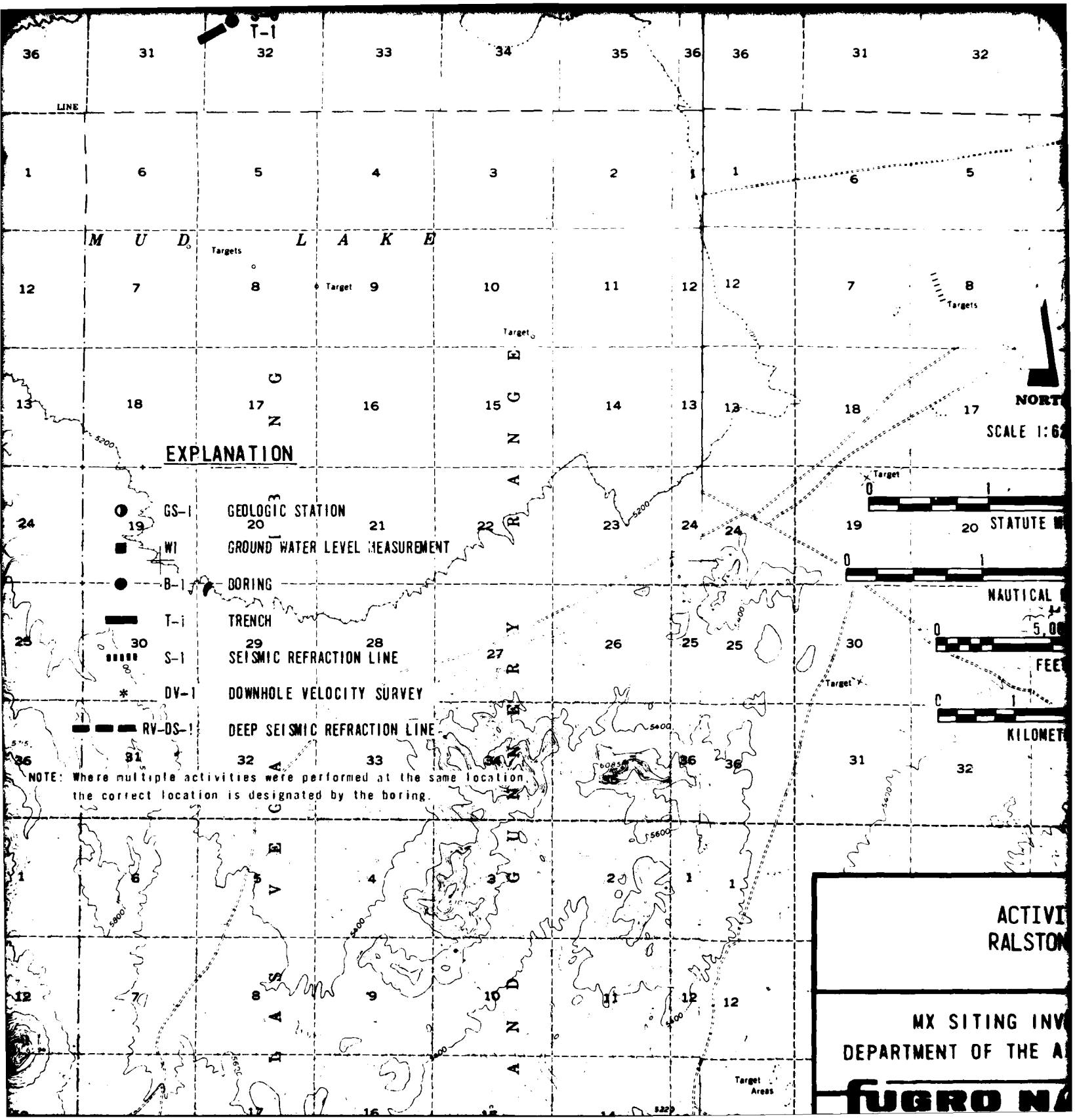

GS-2
GS-1
W6
B-16
S-16
T-8
W7
BM 5404
GS-21B
GS-9B
GS-20
GS-8
Monitor P

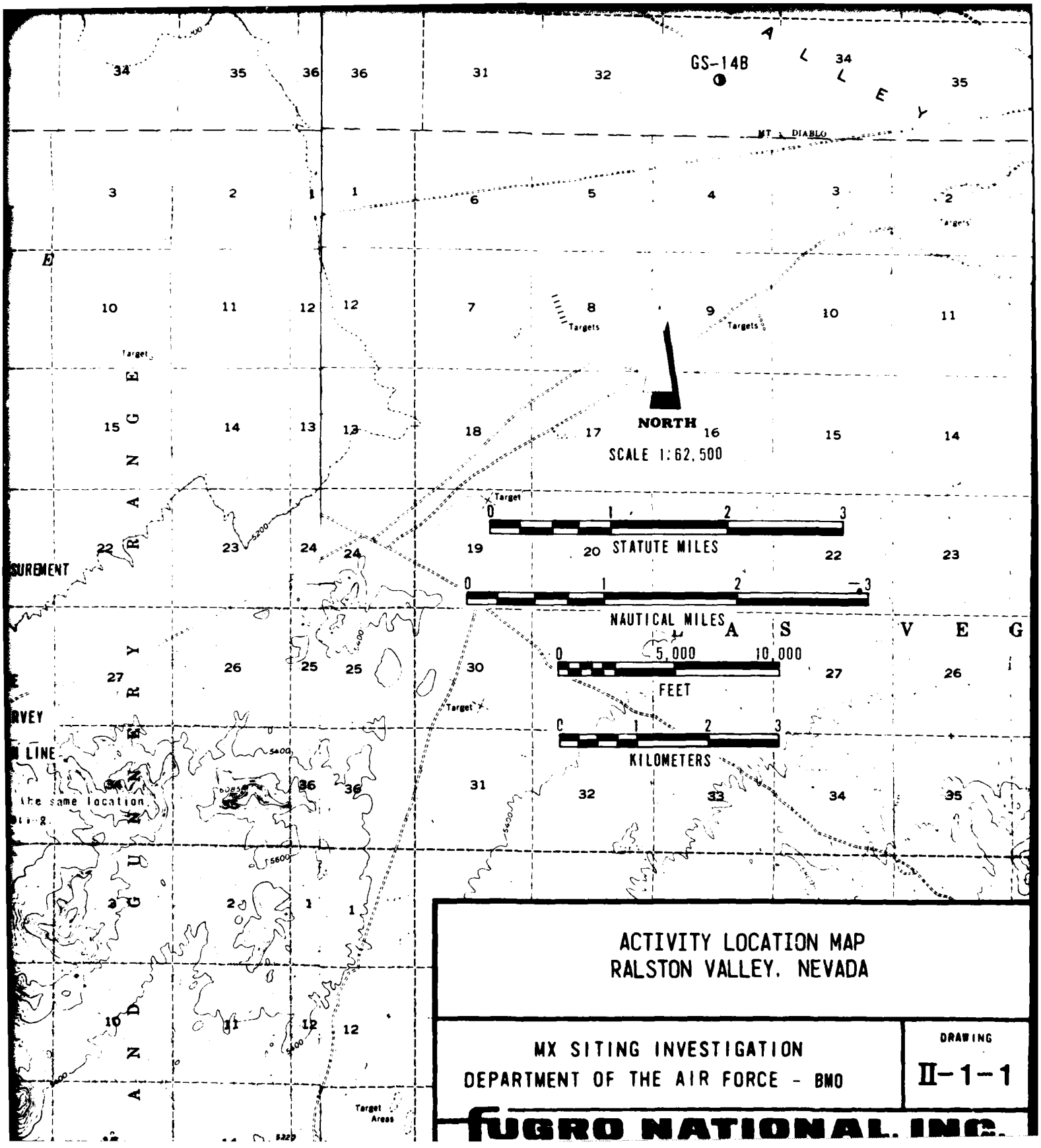

9
Gold Seam Mine
ESMERALDA CO
NYE CO
Targets
GS-25B
GS-14
GS-15
GS-27
B-7
S-7
T-2
GS-16
Mining Area
GS-26B
GS-28B
DIABLO
GS-27B
BASE
LINE
BOUNDARY
APPROXIMATE
GS-29B
M
U


GS-16B
GS-15B
GS-17B
GS-18B
GS-9B
GS-10B
GS-11B
GS-13B
GS-14B
B-5
S-5
DV-5
B-6
S-6
T-1
Targets
Target
NORTH
SCALE 1:62,500
EXPLANATION
GS-1 GEOLOGIC STATION
WI GROUND WATER LEVEL MEASUREMENT
B-1 BORING
STATUTE MILES
NAUTICAL MILES


GS-9B
GS-20
GS-8
GS-15B
GS-10B
B-5
S-5
DV-5
GS-11B
GS-18B
GS-13B
GS-12B
GS-14B
MT. DIABLO
Targets
Target
NORTH
SCALE 1:62,500
STATUTE MILES
NAUTICAL MILES
LIVERMORE VALLEY
SAN RAMON VALLEY
ASVEG


GS-28B
GS-27B
GS-29B
BOUNDARY
APPROXIMATE
ESMERALDA CO
NYE CO
NOTE: Where multi
the correct


T-1
LINE
MUD LAKE
Targets
Target
Targets
Target
Target
Target
Target
Target
Areas
EXPLANATION
GS-1 GEOLOGIC STATION
WI GROUND WATER LEVEL MEASUREMENT
B-1 BORING
T-1 TRENCH
S-1 SEISMIC REFRACTION LINE
DV-1 DOWNHOLE VELOCITY SURVEY
RV-DS-1 DEEP SEISMIC REFRACTION LINE
NOTE: Where multiple activities were performed at the same location, the correct location is designated by the boring.
SCALE 1:62
STATUTE
NAUTICAL
FEET
KILOMET
ACTIVI
RALSTON
MX SITING INV
DEPARTMENT OF THE A
FUGRO NA



ACTIVITY LOCATION MAP
RALSTON VALLEY, NEVADA

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMO

DRAWING
II-1-1

FUGRO NATIONAL, INC.


FILMED
5-8